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General Articles

AN EXPERIMENTAL ENQUIRY CONCERNING SO-CALLED SEWAGE POISONING IN CATTLE

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From time to time allegations have been made that cattle may exhibit signs of ill-health following the consumption of water containing human sewage. In fact, some members of the veterinary profession have gone so far as to assert that in cattle which have consumed human sewage a definite pathological condition develops, which they have called "sewage poisoning." Under the influence of this opinion, claims for damages to cattle on account of alleged sewage poisoning have been preferred on a number of occasions and in many cases the court has declared in favour of the view that the damage was in fact caused by sewage. On the other hand, it has been claimed that there is no scientific foundation for the existence of such a condition, and that the symptoms shown are really referable to other causes, *e.g.*, disease or diseases to which cattle are commonly subject, the drinking of sewage-polluted water being merely coincidental.

In connection with a claim for damages which was recently before the courts, the present authors decided to conduct an experimental enquiry into the question of sewage poisoning in cattle, and the object of this article is to discuss the results. Incidentally, the opportunity is taken to call attention to relevant observations in the literature on the subject.

General Literature Review

It is well known that the main consideration in connection with the contamination of water supplies with human sewage lies in the possible conveyance to man of such intestinal diseases as typhoid fever. Apart from this the literature concerning the influence of sewage-contaminated water upon living things mostly relates to fish and plant life. When excessive quantities of sewage are present in a stream or river, so much of the oxygen may be fixed that fish may be suffocated. The matter has been fully considered by the Royal Commission on Sewage Disposal appointed in 1898. The Eighth Report of this Commission, published in 1912, suggests that the most satisfactory test for effluent is to determine its capacity to absorb dissolved oxygen, the test being applied to the effluent with its suspended solids. Within five days at 65°F., absorption of dissolved oxygen should not exceed 2 parts by weight per 100,000 parts effluent. Also, the effluent should not contain more than 3 parts suspended solids per 100,000. Such an effluent, if mixed with eight times its volume of river water of average purity, would give a mixture which would not take up more than 0·4 parts oxygen in five days at 65°F., leaving 0·6 parts per 100,000 in the river, an amount which is sufficient to support fish life. It has been pointed out, however, that certain amounts of sewage may be directly or indirectly beneficial to fish. These animals are known to feed upon excremental matter; in fact, at some sewage farms in Germany fish-rearing establishments at one time existed, the ponds being fed with the effluent, which was especially suitable for the development of small crustacea on which fish live.

With regard to plant life, there are numerous references in the literature to the high value of sewage as a fertilising agent. In some districts the solid by-product of sewage, known as "sludge," is in great demand by farmers for fertilising purposes, and Clifford (1926), dealing with the disposal of sludge on farm land remarks that the "new grass which appears on sludge-fertilised land is dark green, plentiful and grazed eagerly by stock."

With regard to any possible bad effect of human sewage upon the health of domestic animals, there is in the literature a strange and perhaps significant silence. Mayall (1927) comments on the fact that the veterinary literature on this subject seems to be very sparse and that he has looked through many volumes without finding much reference to it. It may be remarked that this is true not only of the literature of this country, but also of that of the Continent. Levie (1925, 1927), however, states quite definitely the view that sewage is harmful to cattle, the symptoms being "loss of appetite and condition, unthriftiness, drowsiness, weariness, scouring and, in some animals, vomiting. Occasionally, a swelling appears in the region of the throat which, on examination, proves to be septic in character. Cattle kept solely on water containing a high proportion of crude sewage will die in the course of about six months." When cattle showing the above symptoms—without complications—are allowed clean water they improve in health, usually in from three to six months. Levie would anticipate that if cattle consumed water containing a high percentage of sewage they would purge. Further, he considers that the drinking of sewage water would render animals more susceptible to such pathogenic organisms as the bacilli of tuberculosis, Johne's disease and contagious abortion. He admits, however, that only a few of the "rank-and-file" of the veterinary profession share his views. For the rest, his evidence must be considered largely circumstantial, resting as it does solely upon his experience that cattle improve in condition when given a "clean" water supply. No attempt is made to exclude other possible causes of the symptoms observed.

McLachlan (1930) criticises Levie's statements, and points out in particular that there is no indication that Levie has tested the effect of keeping cattle, supposed to be suffering from sewage

poisoning, on the same land but watered only from a clean source. McLachlan also points out that water given to cattle should not be condemned on the result of a chemical analysis, except when some definite chemical poison is proved to be present in it. Even water with an oxygen absorption figure of 7·8 per 100,000 may be perfectly safe.

F. Smith (1905) points out that it is well known that certain specific diseases of animals, *e.g.*, glanders, cattle plague, may be conveyed through water, just as cholera and enteric in human beings may be so transmitted. "If, on the other hand, we are asked to indicate impurities in water which produce disease it is really a very difficult matter." Apart from digestive disturbance of a mechanical nature through animals drinking very hard water, or water containing considerable quantities of mud, there is nothing in water capable of producing disease, unless specific organisms gain access to it.

Linton (1921) points out that the state of our knowledge concerning the effect upon animals of drinking sewage-polluted water is not satisfactory. So far as this author is aware, there is no evidence that sewage-polluted water does definitely cause illness, though in his opinion no one can say with authority that it is free from danger. On the other hand, it is pointed out that cows on sewage irrigation farms constantly eat under the soiling system grass fresh cut from the irrigation beds and frequently wet with undiluted sewage, and this without apparent harm.

The Editor of *The Journal of Comparative Pathology and Therapeutics* (1906), in reviewing evidence given in an action before the Scottish courts regarding an alleged outbreak of sewage poisoning, states: "There is no really trustworthy evidence to show that impure water, or water highly contaminated with sewage, is capable of causing abortion, or that it is in any way injurious to cattle or other animals by reason of the organic matters, bacteria, or bacterial products, present in it. The contrary opinion appears to be a survival from the dark ages of pathology, and it has not yet become extinct, partly because of the loose and inaccurate notions which are still current with regard to the pathogenic powers of the common putrefactive bacteria, and partly because it has been unjustifiably assumed that since sewage-contaminated drinking water is dangerous for human beings it must also be dangerous for farm animals"; and further, "The truth appears to be that this belief in the evil effects of sewage contaminated water on cattle and other domesticated animals has arisen from a slovenly habit of investigation on the part of those who have been called in to discover the cause of the symptoms."

The possibility that water pollution by human sewage might have poisonous effects upon stock does not appear to have entered the minds of authors who have compiled text-books on the subject of sewage disposal, *e.g.*, Kershaw (1925), Veal (1927), Flood. Kershaw, in referring to the raising of cattle on sewage farms, merely remarks that the animals should not be allowed to roam loose owing to the damage they cause by "pocketing" the land with footprints, in which the sewage stagnates. This is especially the case on heavy soil. It is, however, a well-known fact that cattle are kept on sewage farms and that they will readily drink water containing sewage; thus Roechling (1912), writing of the Berlin sewage farms, states that numbers of horses, cattle, sheep and pigs are kept on the farms, *e.g.*, during the year ending March, 1910, the cattle population was 1,560, including 524 cows. On an average each cow gave 2·39 gallons of milk per day and the gross income from the sale of milk amounted to £17,486. During the year an outbreak of abortion occurred among the cows, but the author does not suggest that this had anything to do with sewage. Harvey (1908) says that on the Merthyr sewage farms most of the surface irrigation land is let to tenants for grazing and hay crops. During the summer the land frequently carries 40 to 50 milch cows, 500 to 700 sheep and 40 to 50 horses, and he says, "Cattle and horses will often drink sewage water as it flows along the distributing channels with no ill-effects."

Reid (1903), then Medical Officer of Health for Staffordshire, states, in the course of an address, that "As regards cattle drinking, it is by no means established that animals do suffer from drinking river water polluted even by crude sewage, and I know of no instance in which injury has resulted in the case of streams which receive properly purified effluents, according to our present ideas of purification."

Parkes and Kenwood (1929) state that to reap the greatest profits from a sewage farm a dairy should be established and the produce of the farm thus converted into milk and meat. The milk and meat from animals fed on such produce in no way differ from such products on ordinary farms.

Thus, a review of the literature would not lead one to suppose that human sewage was detrimental to cattle; nevertheless, for the reasons mentioned in the introduction, it was judged expedient to submit the matter to experimental enquiry. For this purpose sewage was obtained from a sewage disposal plant and fed to three cattle over a period of about 21 months. The general result of this experiment was that in spite of the large quantity of sewage water consumed, the cattle remained in good health, while the only pregnant cow gave birth to a really fine calf at full time, eight months after the commencement of the experiment. None of the animals on *post-mortem* examination showed abnormalities attributable to the sewage.

The Plant from which the Sewage was Obtained

We are indebted to Mr. W. C. Easdale, the designer of the works, for the following description of the plant.

The works are designed to deal with the sewage from a population of 2,800 persons at 25 gallons per head per day—70,000 gallons, *plus* an allowance of 50,000 gallons of sub-soil water leaking into the sewers, making a total of 120,000 gallons per day.

The sewage when it reaches the works first passes through rough screens and is then collected in a large underground storage tank having a capacity of 42,000 gallons. From this tank it is pumped up into an overhead balancing tank with a capacity of 15,000 gallons by means of which the rate of flow to the settling tanks is regulated. From the balancing tank the sewage flows to the settling tanks, three in

number, and having a total capacity of 75,000 gallons.

A large proportion of the solids in suspension in the sewage is settled out in the balancing and settling tanks and the clarified liquor from the latter flows direct to three percolating filters of clinker, each 62-ft. in diameter by 6-ft. deep, the total capacity being 2,000 cubic yards. The liquor is distributed over the surface of the filters in sprays by revolving sprinklers and as it percolates through the clinker the organic matters in suspension and in solution are oxidised by bacterial action. The effluent from the filters finally passes through two humus tanks with a capacity of 10,000 gallons, and thence direct to the stream.

The sludge collected in the balancing and settling tanks is discharged at intervals as required into a special sludge digesting tank having a capacity of 31,000 gallons. Normally this tank is kept full and at intervals the sludge at the bottom, which is most thoroughly digested, is drawn off and pumped to special sludge drying beds of ashes. The liquid drainage from these beds flows back to the storage tank for further treatment with the crude sewage and the sludge when dry is removed and spread on the land for use as fertiliser.

In the event of continuous heavy rainfall the volume of sewage taken to the settling tanks and filters is limited to three times the normal dry weather flow and any excess above this volume is diverted into two special storm water stand-by tanks with a capacity of 57,000 gallons. After the storm is over the contents of these tanks are run back into the storage tank and mixed with the crude sewage for further treatment.

Characters of the Sewage Effluent and of the Crude Sewage

The term "effluent" implies purified sewage as it was discharged into the stream, while "crude sewage," as used here, indicates the material immediately before it passed into the sprinklers.

The effluent as received at the Institute was a faintly opalescent liquid with an earthy smell and a faint yellow coloration. In reaction it was neutral to litmus and on centrifuging it gave no deposit. The crude sewage showed an opalescence which was about equal to that of cow's milk diluted with 800 parts of distilled water, of rather lower density than Brown's $BaSO_4$ tube No. 1, and about three times the density of the effluent. Its reaction was neutral to litmus; its odour faintly putrefactive and it yielded a slight black sediment on being centrifuged.

On four occasions during the experiment samples of the sewage fed were examined by Dr. J. F. Beale.* His results are given in Table I (overleaf), which also shows analyses of effluent taken from the discharge pipe of the sewage works (A) concerned in this enquiry; of effluent from other sewage works (B and C) in the neighbourhood, and of samples of water from the stream above the point of discharge of sewage works (A).

It appears from the figures given in Table I that the effluent taken at the works (A) is definitely more impure than the water from the stream above the outlet. Unfortunately, the effluent fed to the cattle cannot be compared with that taken from the outflow pipe at the works because, with the exception of samples numbered 4 and 26, the samples were not taken for analysis at the same time. The effluents from both sources, however, would have been classed as satisfactory under the conditions recommended in the Eighth Report of the Royal Commission on Sewage Disposal.

DESCRIPTION OF THE EXPERIMENT

The feeding of sewage was begun on September 30th, 1931, and ended on July 8th, 1933.

The Animals Used.—Three animals of the Ayrshire breed, purchased from a certified herd, were used in the experiment. Cow Kathleen was aged five years one month, was in her third lactation and due to calve on June 2nd, 1932. She gave birth to a living bull calf on May 26th, 1932. Cow Noline was aged four years nine months, had had two calves, but at the time of the experiment was dry and could not be got in calf. Heifer Blackberry was 18 months old and had not been served.

Thus, animals of different ages and conditions were selected for the experiment, and all three had passed the tests for tuberculosis, contagious abortion and Johne's disease. Kathleen and Noline were examined several times when in milk and were free from mastitis. Since it was necessary to keep the animals as free as possible from risk of contracting contagious disease and under close observation, they were housed in roomy loose boxes at the Research Institute throughout the experiment.

Feeding.—Care was taken that the animals did not receive more than a maintenance diet. Noline and Blackberry received a ration of crushed oats, broad bran and hay, the daily allowance in pounds being: five, five and twelve with Noline, and four, four, ten with Blackberry. As Kathleen was in milk, the daily ration was supplemented with a cake mixture composed of equal parts of linseed and decorticated cotton cake, the amounts of which were varied from time to time, as shown in Table II (p. 151).

* We are indebted to Dr. J. F. Beale, Consulting Analyst, for making analyses of the sewage fed to the cattle and for permitting us to reproduce for comparison other analytical results made by him.

Table I

Number of Sample.	Source.	Date of Sampling.	Appearance.	Colour.	Odour.	Suspended Matter.		Cl.	Nitrites.	Nitrates.	Ammonia.		Oxygen absorbed.		Impurity Figure.	*Bact. coli.*	*Cl. welchii.*
						Total.	Volatile.				Free.	Albuminoid.	In 3 hours at 37° C.	From Solution in 5 Days.		Per c.c.	Per c.c.
1	Effluent fed to cattle	Oct., 1931	Bright, deposit of of humus.	Yellow	Earthy	<1·0	<1·0	7·4	Trace	3·2	0·75	0·09	0·64	1·4	7·7	+0·0001	—10
2	do.	Nov., 1931	do.	do.	do.	<1·0	<1·0	4·4	do.	1·25	0·05	0·08	0·66	1·0	7·3	+0·001	—10
3	do.	July, 1932	do.	do.	do.	<1·0	<1·0	2·5	do.	0·28	0·53	0·05	0·46	0·96	4·8	+0·0001	—10
4	do.	July 4th, 1933	Bright, slight deposit of humus.	Faint yellow	do.	1·04	0·84	7·9	do.	2·8	0·475	0·05	0·61	1·77	5·8	+0·01	—
5	Crude sewage, dil. 1 : 10 tap water	Feb., 1932	Bright, deposit of humus.	Yellow	do.	2·8	1·0	5·6	do.	1·75	0·54	0·15	1·24	1·65	13·7	+0·0001	—10
6	do.	July 4th, 1933	Faint opalescent, slight deposit of humus.	Faint yellow	Strong earthy	1·84	1·46	3·2	do.	0·12	0·65	0·05	0·53	—	5·4	+0·001	—
7 to 21	Effluent from sewage works A	Mar., 1930	Bright, deposit of humus.	Yellow	Faint earthy	<1·0	<1·0	5·7 (0·46)	do.	2·0 (0·17)	0·62 (0·08)	0·107 (0·02)	0·78 (0·08)	—	9·3 (1·4)	—0·0001	—10
22	do.	July, 1930	do.	do.	do.	2·5	1·7	8·7	do.	3·3	0·86	0·18	1·4	—	16·0	—0·0001	—10
23	do.	July, 1930	do.	do.	Earthy	2·0	1·4	5·2	do.	3·2	0·65	0·18	2·24	—	20·2	+0·0001	+0·1
24, 25	do.	Apr., 1931	do.	do.	do.	<1·0	<1·0	5·2 5·4	do.	2·0 1·65	0·125 0·04	0·065	0·49 0·53	0·75	5·7 5·9	+0·001	+10
26	do.	July 11th, 1933	Bright, slight deposit of humus.	do.	Faint earthy	1·4	1·0	9·2	Absent	3·4	0·055	0·07	0·72	0·3	7·1	+0·01	—
27	Effluent from sewage works B	Mar., 1930	Slight, brown deposit.	Brown	Earthy	<1·0	<1·0	7·9	Trace	1·25	2·85	0·14	1·07	—	12·3	—0·0001	—10
28	Effluent from sewage works C	Mar., 1930	Bright, brown deposit.	Faint yellow	Faint earthy	<1·0	<1·0	4·0	do.	0·4	0·12	0·015	0·16	—	1·6	—0·0001	—10
29	Effluent from sewage works C	Mar., 1930	do.	do.	do.	<1·0	<1·0	3·6	do.	0·42	0·43	0·025	0·27	—	2·6	—0·0001	—10
30 to 40	Stream water above point of discharge of sewage works A	Mar. } 1930 Aug. } Feb. Mar. } 1931 Apr.	Deposit of vegetable débris and pond life.	Faint yellow or yellow	do.	<1·0	<1·0	3·7 (0·86)	do.	0·23 (0·046)	0·068 (0·031)	0·04 (0·01)	0·55 (0·13)	0·31 (0·03)	4·8 (1·2)	+0·1 or 0·01 3 samples neg.	+10 4 samples neg.

NOTES.—(1) The figures represent parts per 100,000.

(2) The impurity figure $= \frac{(\text{Alb. ammonia} \times 100) + (O_2 \text{ absorbed} \times 10)}{2}$

For a really good effluent the impurity figure should not exceed 10.

(3) With samples 7 to 21 and 30 to 40, unbracketed figures correspond to arithmetic mean and bracketed figures to the standard deviation.

Table II

Milk Yield and Daily Ration of Kathleen

Period.	Average Daily Milk Yield. (Gallons.)	Daily Ration (pounds) of :			
		Oats.	Bran.	Cake Mixture.	Hay.
9.10.31 to 21.12.31 ...	1·7	1·5	1·5	3	15
22.12.31 to 7. 1.32 ...	1·5	1·5	1·5	5	15
8. 1.32 to 4. 5.32 ...	0·76	1·5	1·5	7	15
5. 5.32 to 26. 5.32 ...	/Dry	5	5	—	12
27. 5.32 to 13.12.32 ...	3·1	1·5	1·5	7	15
14.12.32 to 8. 2.33 ...	1·0	1·5	1·5	5	15
9. 2.33 to 8. 7.33 ...	0·45	1·5	1·5	3	15

Nature and Quantity of Sewage Consumed

The sewage was brought by carrier from the plant 20 miles away to the Research Institute in sealed churns holding 12 to 15 gallons. Delivery was made twice and sometimes three times weekly, the liquid being stored in a cool outhouse until it was used. The animals gave no indication that the liquid was distasteful and it was always readily consumed. Table III shows the quantities (in gallons) and kind of sewage consumed during the experiment, the order in which the different kinds of sewage were given and whether given diluted with tap water or undiluted.

Table III

Total Consumption of Sewage and of Water during the Experiment

Duration (in days).	Kind of Sewage.	Times diluted.	Kathleen.		Noline.		Blackberry.	
			Sewage.	Water.	Sewage.	Water.	Sewage.	Water.
15	Effluent	10	16	144	13¼	119¼	8	72
89	do.	5	219½	878	142¾	571	104¾	419
7	Crude	100	3	297	1½	148½	1½	148½
12	Effluent	2½	71¾	107½	39	58½	32½	48¾
91	do.	2	555¾	555¾	383½	383½	332¼	332¼
435 { 83	Crude	10	110¾	996¾	336¼	3,026¼	288	2,592
435 { 352	Effluent	Undil.	4,170	—	—	—	—	—
649	—	—	5,146¾	2,979	916¼	4,307	767	3,612½

Condition of the Animals while under Experiment

Throughout the experiment the animals remained in excellent condition and no ill-effects referable to the drinking of sewage were observed. That this was so may be seen from the photographs (overleaf).

With Kathleen on December 2nd, 1931, a large abscess formed beneath the skin of the abdomen just in front of the udder, and a bacteriological examination of the contents showed that this was due to *C. pyogenes*, an organism which quite commonly causes suppuration in cattle. After the contents had been evacuated, the abscess rapidly healed. Chart I (page 153) shows the body weights of the animals, as recorded at weekly intervals.

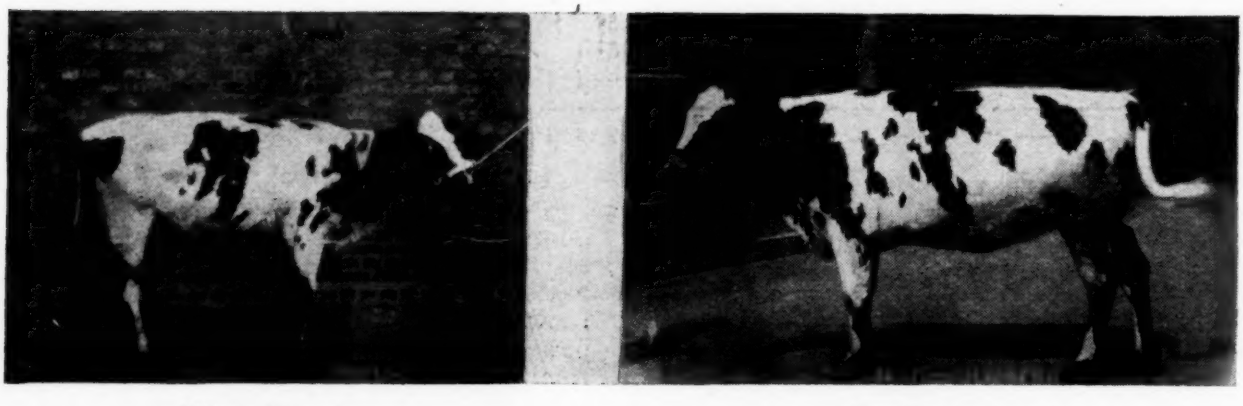
THE EXPERIMENTAL ANIMALS

Before Experiment. After Experiment.

Cow Kathleen.

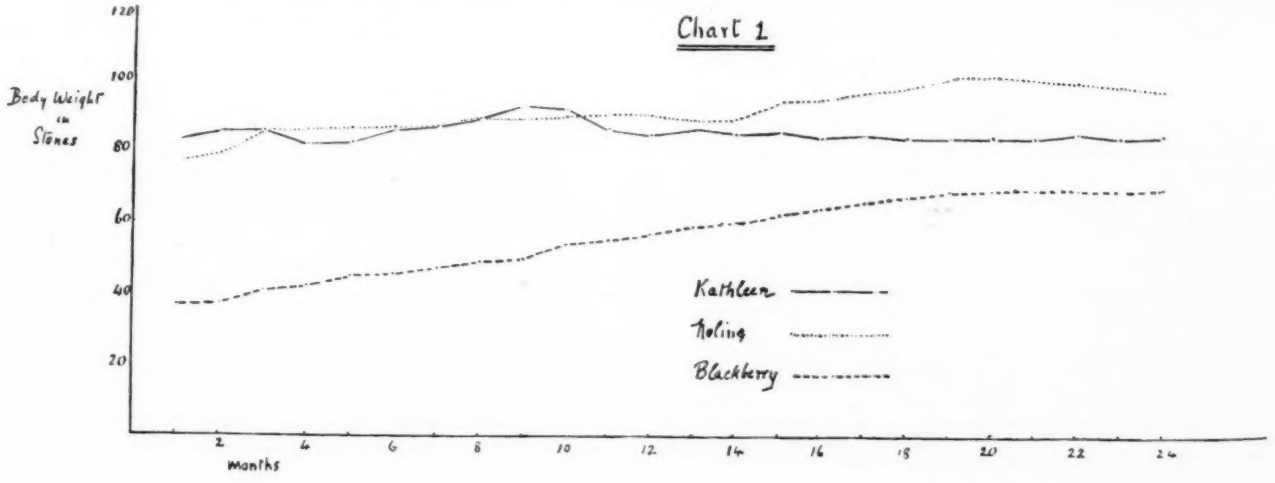
Before Experiment. After Experiment.

Cow Noline.



Before Experiment. After Experiment.

Calf Blackberry.



From Chart I it will be seen that Kathleen maintained her body weight and that the weights of Noline and Blackberry increased during the experiment.

The milk yield of Kathleen during the second, third and fourth lactations was 626, 602 and 731 gallons respectively. During the fourth lactation (58 weeks) her average daily yield amounted to 1·8 gallons. The experiment was begun when Kathleen had completed 14 weeks of the third lactation and was continued during the whole of the prolonged fourth lactation. It will be seen, therefore, that the milk yield of this cow did not suffer as the result of drinking undiluted sewage effluent. The milk was examined bacteriologically several times during the fourth lactation but no abnormalities were found.

Post-mortem Examination

On July 19th, 1933, eleven days after the conclusion of the experiment, the three animals were slaughtered, and a *post-mortem* examination was carried out immediately.

Blackberry.—Carcass in very fat condition and the organs healthy.

Noline.—Carcass in very fat condition. The only abnormality discoverable was a cystic condition of the ovaries, which was no doubt the cause of the animal's sterility.

Kathleen.—Carcass in fair condition and in good health, with the following exceptions: the liver was affected with cavernous angioma and with slight cirrhosis due to flukes. One ovary contained a cyst and there was also a small cyst in one kidney. In one of the mediastinal glands there were a few small lesions resembling those of tuberculosis. The nature of the tubercle bacilli in these lesions was investigated by inoculating guinea-pigs, from which cultures were raised on plain egg medium. As the strain was inhibited by glycerine and set up progressive tuberculosis in rabbits following subcutaneous inoculation, it was judged to be of the bovine type.

The abnormalities found on *post-mortem* examination of Kathleen and Noline are quite commonly found at the examination of cattle killed for meat, especially in older animals. They cannot, therefore, be ascribed to dietetic causes such as the feeding of cattle on sewage. In the examination of the animals search was especially made for the lesions which are alleged to be prominent in cases of sewage poisoning, *viz.*, cystitis, suppurative metritis, atrophy of the spleen; but there was no sign of such lesions. Finally, the three carcasses were carefully examined by the meat inspectors and passed as perfectly fit for human consumption.

Discussion

It may be well to recall for a moment what sewage is. There are in reality two kinds of sewage, domestic or household sewage, and trade or industrial sewage. In this article we are not concerned with industrial sewage, *i.e.*, waste products from industrial activity, sewage of variable composition and which may contain poisons well known to toxicologists. Household or domestic sewage is water containing human urine and fæces mixed with kitchen and other waste, a product variable in composition but always containing quantities of soap and grease. After this mixture has reached the sewers it often receives drainage from animal habitations diluted with a variable amount of subsoil water.

Before such materials are allowed to pass into streams or rivers they have to be subjected to a process of purification, in the course of which a large proportion of the solids are removed by sedimentation and filtration. During the process of filtration the fluids are thoroughly ærated and through bacterial action the organic material is broken down, so that on discharge the effluent should conform to a standard which has been defined by the Royal Commission on Sewage Disposal. The effluent, then, from a modern sewage works is a practically clear fluid, consisting of water with salts and organic matter in solution and minimal quantities of solids, including fats and bacteria in suspension.

If the subject is considered from the chemical and bacteriological standpoints, it is impossible to cite any known constituent of the effluent which would be harmful when ingested by

domesticated animals. This is a point which we think need not be laboured. When, however, cattle which have access to streams into which effluent is discharged become ill, what is the condition—pathological or other—from which they suffer? It is in part the difficulty of producing a convincing answer to this question which has led the courts on occasion to accept the plea of "sewage poisoning." Since the chief symptoms which have been associated with sewage poisoning are unthriftiness or definite wasting and disturbances of the intestinal tract, it may safely be inferred that the pathological conditions which may be confused with sewage poisoning are tuberculosis, Johne's disease and parasitic infestations, *e.g.*, with nematodes or trematodes. Unthriftiness may also, of course, be due to an inadequate water supply or to malnutrition, and such influences may be complicated by disease. Malnutrition may be caused, for example, by the indifferent nutritive value of the herbage on wet pasturage adjoining water courses. Hence, it is not surprising that, when animals are removed from such pasturage, they improve in condition. It may be said by those who hold an opposing view on the subject that the pathological conditions mentioned can be distinguished from sewage poisoning. Unfortunately, it cannot be agreed that a correct diagnosis is always established, and this is due either to the unavoidable difficulties of the case or because full advantage has not been taken of existing knowledge. This point again may be illustrated by means of an example. We have already said that in our view Johne's disease may be responsible for symptoms which have been ascribed to the consumption of sewage.* This view might be vigorously contested by anyone who had not made a careful johnin test of all adult animals in the herd or by one who holds fast to the belief that once an animal becomes infected with Johne's disease it invariably dies of the disease. Closer acquaintance with herds in which Johne's disease is known to be present is making it evident that epizootologically the disease is similar in many respects to tuberculosis in that infection, as revealed by johnin testing of the whole herd, may be widespread and far exceed the annual loss by death of those animals which reach the clinical stage. It is clear, moreover, that Johne's disease is essentially one in which "environment" in the broadest sense plays an enormous part. Already it is recognised that the system of feeding and maintenance may largely determine the duration of life once symptoms have developed. Now the experimental study of epidemiology has shown how complex is the relationship between parasite and host, and that the final outcome in a given case will depend upon a multitude of factors, such as (*a*) the dose of the parasite absorbed, and the frequency of the dosing, which in turn are dependent upon the proportion of infected individuals in the herd and the degree of crowding; and (*b*) the resistance—natural or acquired—of the host, which is dependent upon still other factors. It is certain that Johne's disease will be no exception to the general rules which hold in the science of epidemiology. On general grounds, therefore, it can be predicted that animals infected with Johne's disease would not invariably die of the disease, but that they would remain infected for long periods and either show no noteworthy symptoms, or symptoms which may be slight and intermittent. Direct evidence as to the validity of these predictions is accumulating slowly but surely.

Objection may be raised to the experiment described in this article, on the grounds that an insufficient number of cattle were used, that the conditions were artificial and that in any case the results obtained are not generally applicable. The animals were carefully watched, however, and it is claimed that if the sewage had possessed noxious properties they would have shown some ill-effects. The objection that the conditions were necessarily somewhat artificial cannot, we believe, be seriously upheld. The total quantity of crude sewage or effluent consumed by each animal was very large, and the dilution generally much less than would be the case under ordinary field conditions with cattle watering at a polluted stream. Indeed, the cow Kathleen consumed neat effluent for eleven months without harm, the daily consumption being on an average 15 gallons, or not less than would be consumed by milking cows at pasture. As to the general applicability of the results obtained, it may be pointed out that the sewage plant was of a kind which is quite ordinarily employed in this country and that the effluent was not found on analysis to be above the usually accepted standard. In any case the proved harmlessness of even crude sewage would dispose of this objection.

Summary

Three healthy cattle of the Ayrshire breed, *viz.*, a cow in milk, a dry cow and a yearling, were allowed to consume during a period of 21 months water containing human sewage. During the course of the experiment the milking cow consumed 5,146 gallons of sewage, and for eleven months the animal drank nothing but undiluted sewage effluent. The other two animals consumed 916 and 767 gallons of sewage respectively; this included 579 and 477 gallons respectively of effluent diluted with water and 337 and 290 gallons respectively of sewage before

* In connection with the action at law, to which reference is made in the introduction, one of us conducted a *post-mortem* examination of a cow slaughtered as a typical case of sewage poisoning. Autopsy revealed naked-eye and microscopical lesions of Johne's disease, as well as biliary cirrhosis caused by *Fasciola hepatica.*

final purification. The animals gave no sign that the fluid was distasteful to them; they thrived normally and maintained or increased their weight; the milking cow gave birth at time to a healthy living calf while under experiment and during the subsequent fourth lactation her milk yield reached 731 gallons (1·8 gallons daily). Thus, the experiment gave no support to the suggestion that human sewage contains some constituent which is poisonous or injurious to cattle. The result was anticipated on grounds of general scientific knowledge and after consultation of such literature as is available, the relevant passages of which are shortly reviewed in this paper. There is, therefore, no real reason for the belief that any such condition as sewage poisoning exists. This inevitably forces the conclusion that the symptoms shown by cattle in alleged cases of sewage poisoning are due to other causes.

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In connection with this work, we wish to express our thanks to Mr. J. F. W. Wheeler, Solicitor, Oxted, and to Mr. A. E. Mundy, Chief Laboratory Assistant.

OVINE COCCIDIOSIS IN MALAYA

The Straits Settlements Veterinary Department has recorded that during 1932 numerous coccidiæ were found in the excrement of Australian sheep at Singapore involved in a severe outbreak of diarrhœa. In August and September some 4,000 sheep were affected, but hundreds of goats grazing in company with them did not become involved. A system of segregating and penning infected animals was adopted, but the scarcity of suitable grazing grounds and the apathy of the owners were together responsible for the continuance of the outbreak well into October. Happily, however, the resultant losses amounted only to approximately 2 per cent.

SEWAGE: IS IT A SOURCE OF POISONING IN ANIMALS?*

I.—From the Clinical Aspect

L. P. PUGH, F.R.C.V.S.
Sevenoaks

When Mr. Macdonald asked me if I would be willing to be one of the openers of this discussion from the clinical aspect, I agreed to do so on the understanding that I might make the recent big law action on this subject the basis of my remarks. Otherwise, I said, I could not speak of any large experience in which sewage had undoubtedly been involved, and so I make no further excuse for going straight on to this case.

I was approached in the first instance by the defendant council, as they were aware that I was rather sceptical as to whether human sewage had any detrimental action on cattle. They informed me that two farmers, some two years previously, complained of damage and loss as a result of their cattle being turned out in their water meadows, the stream to which had been contaminated rather heavily from a defective sewage bed. I was given to understand that they could not very well refute the presence of sewage in the stream as they had been compelled to put the defective bed in order. The broad outline of the clinical history, as told by the farmers, was that when the cattle were turned out in these meadows, instead of the usual looseness of the bowel on grass they developed diarrhœa, capricious appetite, dropped in their milk and gradually wasted away and clinically had all the appearances usually associated with Johne's disease. The cattle, when taken off the pastures, put on dry food and main water, recovered spontaneously in the majority of cases. I gave it as my opinion that since such a large number of cattle had recovered spontaneously they could not have been ill as a result of Johne's disease. I went very carefully into the differential diagnosis, with special reference to parasitic gastritis and fluke infestation, and in the end reported to the council that if the facts of the case were as stated, I could not go into the witness-box to refute the farmers' allegations. I was accordingly dropped as a witness and had practically forgotten the case when I received a subpœna notice to appear in the action from the farmers' solicitor, and found myself in the opposite camp.

The case was heard before Mr. Justice Horridge and took nearly three weeks, the farmers ultimately being awarded damages and costs.

In the High Court this decision was reversed, Lord Justice Scrutton and Lord Justice Slesser

* Discussion at Meeting of the Central Division, N.V.M.A., held at the Conway Hall, Red Lion Square, W.C.1, on January 11th, 1934.

finding for the council and Lord Justice Greer for the farmers.

The veterinary evidence for the defendants was divided into two main themes. Firstly, that human sewage had not and could not affect cattle, and secondly that the symptoms of illness complained of by the farmers could be explained on the basis of their cattle having Johne's disease.

Dealing with the first theme, a great deal of evidence of a controversial nature was gone into, but the main pillar of the argument was an experiment carried out at the Royal Veterinary College on three cattle. These animals were given sewage effluent from the actual sewage farm in question over a long period of time—considerably more than a year—without any apparent ill-effect. One cow, who rejoiced in the name of "Kathleen," was given crude sewage for a number of months, also without effect.

The experiment was not a fair test in two respects. Firstly, the effluent given to the cattle was a totally different effluent from the one that came through the defective filter-bed, and secondly the cattle were not put under anything like the same conditions as those that were existing at the time of the farmers' complaint. You will remember that the cattle recovered more or less spontaneously when removed from the pastures and put on a dry diet and main water. It could hardly be suggested that the main water brought about the dramatic effect, and therefore one is forced to the conclusion that the changed diet brought about recovery. Yet these three animals were submitted to this experiment on a diet which favoured their recovery, or at all events on a diet completely different from the one the farmers' cattle were on. The cattle should have been put on a grass diet similar to the affected cattle. Failure to do so rendered the whole experiment fallacious.

Now dealing with the second part of the theme, I was taught—and it has been my experience as a country practitioner—that when a cow has developed Johne's disease and has become a clinical case she is not long for this world. By judicious feeding and the administration of astringents one may help to check the diarrhœa for a while. If one is lucky one may even get a little improvement in condition, but in 99 per cent. of cases at least they go out or have to be destroyed. Yet the veterinary experts called by the defendant council to refute the alleged sewage poisoning, convinced two of the judges that the majority of these cattle came within a category that is so rare that it is regarded in our journals as of great scientific interest.

Such evidence, I consider, is so contrary to one's experience in the field that I feel it would not have been accepted in an ordinary discussion in this room.

My own conclusion on the possible effect of human sewage in this case was that starting with cattle full of green grass, if one let them have access to sewage (not sewage effluent) loaded with coliform organisms and the products of their activity, then these animals would possibly exhibit a train of gastro-enteric symptoms associated with diarrhœa and wasting from which they would recover spontaneously in the majority of cases if removed from the source of trouble.

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II.—From the Bacteriological Aspect

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The idea that anything of a fæcal or putrefactive nature must necessarily be dangerous is a prevalent one and very old. It is probably a relic of the days when diseases were believed to be caused by bad or foul-smelling air, and of the later period when all bacteria, including those of fæcal or putrefactive origin, were believed to be able to cause disease.

The idea is largely æsthetic in origin, but it has been kept alive in recent times by the fact that human typhoid may be conveyed by fæcal contamination, and the further fact, also known to many, that fish may be killed by the lack of oxygen which results from the gross contamination of their waters.

It is therefore not surprising that stock owners should claim from time to time that their animals have been poisoned by water which they know or believe to have been polluted with sewage. And it is not difficult to understand that a jury of laymen may be easily convinced that such is in fact the case, particularly if there is good circumstantial evidence to support it; *i.e.*, if the animals (they are usually cattle) have shown symptoms whilst watered at the suspected supply and have improved when removed from it.

The General Composition of Sewage and its Effluent.—Before going further, we ought to be agreed as to what we mean by "sewage." "Sewage" is the matter collected and conveyed by the sewers, the construction of which was made incumbent on local authorities by the Public Health Act of 1875, and which are designed to carry off the drainage and excrementitious matter of a human community.

Sewage will therefore contain, firstly, human fæces and urine, and house waste—material of varying composition, according to time and place, but consisting largely of water containing soaps and fats; to this will be added street washings, containing animal fæces and a certain amount of refuse of vegetable origin, and lastly

a varying amount of drainage from animal habitations, usually stables. It will usually not contain bovine excreta, because it is unusual for cows to be kept in towns and in any case arrangements are generally made for the collection of bovine excreta in heaps and tanks for manuring purposes.

Sewage is thus preponderantly of human and domestic origin, the actual concentration of the constituents varying greatly according to the time, place and weather conditions.

There is another kind of waste which may also find its way into the common sewers, that is, industrial waste, a product which may contain well-known specific poisons or bacteria. The term "animal sewage" has also been used. It refers essentially to drainage from animal habitations, and may convey specific diseases.

Such specific and well-known diseases and poisons are, however, I understand, not to be embraced in our discussion to-night.

Purification of Sewage.—Sewage, as I have described it, may not be put into a stream in an untreated condition. By the Rivers Pollution Act of 1876 it was made an offence to discharge liquid or solid sewage or any solid matter into a stream without purification, and since 1898 the question of disposal has been watched over by the Royal Commission on Sewage Disposal appointed in that year. This Commission has been responsible for much experimental and observational work and has issued a series of reports of which the eighth, issued in 1912, suggested that the most satisfactory test for the effectiveness of the purification was to test the material discharged—the effluent—for its capacity to absorb dissolved oxygen and for the amount of solids in suspension. A satisfactory effluent is one which does not, within five days at 65°F., absorb more than two parts of dissolved oxygen per 100,000 parts by weight and which does not contain more than three parts of suspended solids per 100,000 parts. These criteria are laid down, moreover, on the assumption that the effluent will be diluted at least eight times by the water into which it is discharged—a point which has to be borne in mind where a stream or brook is subject to wide seasonal variations.

Alleged Sewage Poisoning in Cattle

It is not only laymen who have taken the view that sewage may be poisonous. Veterinary surgeons—trained observers, familiar with the diseases to which cattle are susceptible on the best of water supplies—have in certain instances also taken this view and their opinions may be held to require consideration. Some have asserted that there exists a definite pathological entity to which the name "sewage poisoning" has been given. The term was, I believe, first put into print by Levie.

Now, what are the symptoms generally given for this so-called "sewage poisoning"? Levie, writing in 1925, said: "Observations on 20 herds of Derbyshire cattle drinking sewage-polluted water have revealed to me that it has the following baneful effects, *viz.*, loss of appetite and condition, unthriftiness, drowsiness, weariness, scouring and, in some cases, vomiting. Occasionally a swelling appears in the region of the throat which on examination proves to be septic in character. Cattle kept solely on water containing a high percentage of crude sewage will die in the course of about six months. When cattle showing the above symptoms—without complications—are allowed clean water to drink, they improve in health. The period required for them to recover is in proportion to the length of period they have been drinking sewage-polluted water. Generally it takes from three to six months for them to recover. Of course, some animals are more susceptible to the influences of sewage than are others." He is also satisfied that sewage predisposes to other diseases and provides an ideal opportunity for specific organisms, *e.g.*, those causing tuberculosis, Johne's disease and abortion to plant themselves in the tissues of the host.

In a further article in 1927, he described an outbreak in which animals showed symptoms and recovered, within a few days or weeks, when successively given access to or removed from a given stream.

Other evidence in support of an allegation of sewage poisoning has been of a similar nature.

We might note at once the nature of the symptoms which are stated to be characteristic of "sewage poisoning," and the fact that many of them are those exhibited by well-known specific diseases such as tuberculosis, Johne's disease and parasitic infections.

In contrast to these assertions that sewage is poisonous we cannot fail to be struck by the almost complete absence of mention of poisoning by sewage in standard veterinary and other works, whilst those authors who have referred to the subject have concluded that it is harmless or that there is at least no evidence to the contrary.

The Bacteria of Sewage.—The bacteria put into sewage may be of a large variety and vary greatly from time to time. They may include the organisms of specific diseases. They will, however, be largely the common saprophytes present in the excreta of human beings. In sewage as it arrives at the disposal plant the preponderating organisms are therefore those of the coliform group, fæcal streptococci and anærobes of the *Cl. welchii* group, in the living or dead state. We have little exact knowledge regarding the fluctuation of the bacterial population during its passage through the purifying

plant, but we may expect a great modification in the relative numbers of each species according to the actual method of treatment adopted at the works and the stage reached. It is certain, however, that the more delicate organisms are greatly reduced or eliminated entirely and we know that the cultivable bacterial population of a good effluent is a hundredth, or much less, of the original population of the sewage (1 to 10,000,000 per c.c.) and may be often as low as 10 to 50,000 per c.c. This does not, of course, give a picture of the actual number of bacteria present, but only of those which grow under the conditions used, *e.g.*, the nitrifying bacteria which are largely responsible for the breakdown of the ammonia produced during organic decomposition to nitrates do not grow on ordinary media. We have no reason, however, to think that these organisms are in any way dangerous.

What can we say with regard to the preponderant flora, coliform bacteria, cocci, and anærobes? The answer would appear to be given by the fact that apparently similar bacteria of all these species are normally present in the intestines of both man and animals, and are, in the ordinary processes of farming, spread broadcast on pastures. There does not seem to be any *a priori* reason why they should be dangerous when derived from human beings and present in water.

Circumstantial Evidence (Poisoning by bacterial products or "special varieties of bacteria").—It has been argued that the fact that we cannot demonstrate any pathogenic bacteria in suspected water supplies is no proof that the supplies are not in fact dangerous, and in support of this contention the suggestion has been made that some bacterium whose pathogenicity is as yet unrecognised may eventually be proved to be pathogenic, or that some special variety of a common saprophyte may be pathogenic under certain conditions or, again, that the alleged damage may be done by intoxication with some unknown bacterial product. In other words, that there is circumstantial evidence that sewage-polluted water is dangerous. In consequence of this, the view has been expressed that direct experiment is necessary.

Before commenting on that, we may refer to the statement which has been made that cattle will not drink sewage-polluted water and that, if no other supplies are available, they will suffer from a shortage of water. This may be refuted, however, by the oft-observed fact that cattle drink freely—and often in preference to better supplies—from water which is filthy and contains decomposing animal or vegetable matter or even their own fæces. That is an observation with which, I think, most veterinary practitioners will agree. It is also refuted by the direct experiments of Professors Minett and Wooldridge and Dr. Sheather, to which I will next refer. Before going further, I should like to express my indebtedness to Dr. Minett, who has allowed me to see the manuscript of the article describing these experiments before it goes to press.

Experiments Carried out at the Royal Veterinary College on the Feeding of Sewage or Effluent to Cattle.—Three Ayrshire cattle, *viz.*, a cow in milk, a dry cow and a yearling were given during a period of 21 months water containing human sewage or sewage effluent.

The milking cow, aged five years, consumed over 5,000 gallons of sewage or sewage effluent diluted or undiluted and for eleven months of this period had nothing but undiluted effluent, totalling over 4,000 gallons; at another period she had 110 gallons of sewage at the stage before it reached the coke-bed sprinklers, diluted 1 : 10 with water.

The dry cow, four years nine months, had 916 gallons of sewage or effluent, diluted with water. The calf, which was 18 months old at the beginning of the experiment, drank 767 gallons of sewage or effluent.

The animals gave no sign that either of the fluids was distasteful to them, but thrived normally and maintained or increased their weight. The milking cow gave birth at time to a healthy calf whilst under experiment and during the subsequent lactation, her fourth, gave 731 gallons of milk (or 1·8 gallons daily), as against 626 and 602 gallons at her two previous lactations. There was thus no support for the conclusion that the sewage contained any constituent poisonous or injurious to cattle.

It has been said that this experiment is not generally applicable and that sewage may be harmless in one place and harmful in another. Apart from industrial pollution, I think we may expect, however, that human sewage effluent, which is what we are asked to discuss to-night, from any one group of two or three thousand people will be similar qualitatively to that from any other group as regards its bacterial flora, particularly since the bacteria of specific diseases are reduced and eliminated during passage through the works. That is not to say that great quantitative variations do not occur. The duration of the experiment covered this variation, however. A further point to be remembered is that the particular sewage or effluent given to these animals was not above the average.

Sewage Farms.—Further direct evidence of the harmlessness of human sewage can be obtained from the fact that cattle, including at times dairy cows, are kept on farms kept for the disposal of sewage under the land treatment method. Such animals may be allowed on the land, but more usually are fed on the soiling system. Under this system they frequently con-

sume large quantities of freshly-cut grass which is still wet with effluent or with screened but otherwise untreated sewage. And there still exist numerous farms where untreated sewage is discharged in fields to which cows have free access. If sewage is injurious to cattle it can only be described as astonishing that those responsible for sewage farms have not seen or reported the injurious effects.

The question is often asked, what is the condition from which the cattle are suffering if it is not due to sewage? The answer must be that the symptoms point more especially to one or more of the following diseases: tuberculosis, Johne's disease and parasitic infestations. And, until these are excluded, circumstantial evidence that sewage-polluted water has caused damage to animals cannot be accepted. I did not intend to say more regarding this. Mr. Pugh has remarked, however, that he was astonished to hear it stated recently that a large proportion of *clinical* cases of Johne's disease recover. That must surely be a misapprehension. What probably is the case is that, whilst nearly all clinical cases die, there are good reasons for believing that infection with Johne's bacilli is far from always being fatal. There are two main reasons for believing that: firstly, the proportion of cattle which react strongly to a johnin test is always far greater than those which show clinical symptoms or which die or are disposed of subsequently on account of Johne's disease. Secondly, all the evidence we have—though admittedly more would be valuable—points to the fact that cattle are difficult to infect with Johne's disease. With one exception the only successful results have been in young calves. I fully believe it will be found that infection with Johne's disease occurs in early youth, that animals exposed to infection later frequently recover or never progress to the clinical stage, and that the result is largely therefore a matter of age and dosage.

Does Sewage Predispose to other Diseases?—Even when it is agreed that there is nothing of a bacterial nature in sewage or sewage effluent which can cause disease in cattle and no well-marked condition or group of symptoms which can be attributed to sewage pollution, it has been suggested—rather, I feel, as a last resort—that sewage-polluted water may act as a predisposing cause to well-known specific diseases. It would require an experiment of a very extensive nature to come to a decision on this point with regard to one disease only.

We are therefore thrown back on the observations which can be made on cattle in the field and in particular on the large numbers which, on sewage farms, are daily exposed to sewage-polluted grass or water. I know of no record of an abnormally high incidence of any specific disease amongst them, nor of a generally high incidence of disease. I think, therefore, that, remembering the fact that sewage-polluted material was being taken and would quite naturally be suspected if disease were unusually frequent, we may conclude that sewage does not act as a predisposing cause to any disease, or to all.

Conclusion.—In conclusion, although it cannot be said that our knowledge regarding the effects of sewage is altogether satisfactory, I think the following facts:—

> (1) That no specific agent, bacterial or other, can be incriminated; (2) that on sewage farms thousands of cattle have been and are being fed on sewage-contaminated materials without ill-effect; and (3) that three cattle have been given quantities up to 5,000 gallons of filtered sewage or effluent, either crude or diluted with water, over a period of 21 months, and have thrived,

can be accepted as indicating strongly that sewage-polluted water does not produce ill-effects on cattle directly or by acting as a predisposing cause.

In effect, that means that the onus of proving that sewage-polluted water has in fact caused disease must necessarily lie on those who allege it. Circumstantial evidence cannot be accepted until all other possible causes of disease have been ruled out or until it has been shown that a well-marked condition can be produced under experimental conditions in animals which are free from other diseases or conditions likely to cause the symptoms concerned. I believe that if sewage (other than certain trade effluents) which is alleged to have poisoned cattle is used under experimental conditions it will again be found to be harmless.

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III.—From the Chemical Aspect

G. D. LANDER, D.Sc.

In considering the possibility of human sewage acting as a poison to animals it is necessary to ascertain as far as is possible the quantity and composition of the excreta which give rise to a normal sewage, and, after treatment, to a normal effluent of the type usually discharged from the disposal plant. The question of the spread of bacterial or parasitic disease does not arise in the strictly toxicological aspect of the matter.

Composition of the Dejecta

(1) *Fæces.*—The average output of fæces per head per day is variously given at from 80 to 120 grams, of which about 75 per cent. is water. Of the solid components from a quarter to a half are stated to be bacteria, mostly dead. In addition there are to be enumerated: epithelial casts; residues of digestive juices, including biliary pigments; cellulose; indole,

scatole and sulphur compounds of the mercaptan type; mineral salts; and traces of fats, amounting to about 4 per cent. of the fat intake.

Abnormally there may also be present—undigested residues of food; residues of drugs; calculi; and parasites and their eggs.

That fæces possess no nutritive value is obvious, but it is fallacious to describe them as poisonous, or dangerous, although from the human standpoint they may be æsthetically revolting. Definite components such as indole are not, ordinarily speaking, poisonous.

(2) *Urine.*—The average daily excretion is about one-and-three-quarter to two-and-a-quarter pints—say one quart. The quantity of solid per day amounts to about 55 grams, of which about one-third is mineral consisting chiefly of phosphates, chlorides and sulphates of sodium, potassium, calcium and magnesium. Urea, forming 2 per cent. of the average fluid, is the chief organic component and amounts to about 10 grams per day, uric acid and allied purine compounds, and creatinine forming about 0·2 per cent. or 1 gram per day. Traces of phenols are also found.

In the healthy subject urine is sterile and contains no albumens, but under pathological conditions these, as well as sugars and ketonic compounds, may be found.

We certainly know more of the qualitative composition of urine than we do of that of fæces, but we may allow, without argument, that both are valueless as nutritive materials, so that an exclusive dietary of these things would cause damage.

The only components round which a case for poisonous qualities might be woven are the so-called albuminoid matters. In food analysis these are quantified by determining nitrogen, other than that present as ammonia or nitrites or nitrates, and multiplying by a factor. Since from our present point of view the only thing that really matters is the qualitative character of the albuminoids, any such data are useless. Albuminoid is an omnibus word covering such a varied range of bodies as the proteins of grain, meat, eggs, milk, etc.; phyto- and zoo-toxines, and those of bacterial origin.

Having regard to the natural occurrence and situation of human excreta in the organism, we are entitled to say that there is no evidence that they are toxic to man or to animals.

Sewage

In ordinary practice a sewage disposal system provides for a gallonage of some 25 per head per day of the population, which, it will be seen from the data quoted above, implies a hundred-fold dilution of the original dejecta. The extreme importance of this big dilution needs no emphasis. The crude sewage, in addition to the highly diluted excrementa, contains notable proportions of paper (cellulose), soaps, and weak alkali from bath and washing-up water, to say nothing of such odds and ends as often find their way down the drains. Industrial or trade waste liquors may raise special local problems, but do not come within the purview of the present discussion.

It is not necessary to do more than indicate the broad principles of the process of purification to which the crude intake is subjected before discharge as an effluent.

The liquid lies for some hours in the settling tanks, where one can with fair accuracy state that fermentative processes already initiated in the alimentary tract are carried further. Thus it is remarkable that the cellulose is rapidly destroyed, presumably by anærobic fermentation, to carbon dioxide and methane; organic sulphur is largely converted into sulphuretted hydrogen; albuminoids are further broken down into relatively simple amino-acids; and urea into ammonia and carbonic acid. The final purification consists in filtering the liquor from the tanks, distributed by means of rotating sprays, through beds of clinker or breeze. In this process ærobic fermentations and oxidation occur, and the most marked result is the conversion of practically all the "organic" nitrogen into nitrates.

The disappearance of the micro-organisms of crude sewage runs *pari passu* with the two-fold processes of digestion and oxidation outlined above, and for this reason chemical analysis is valuable in so far as it indicates the degree of purification, or helps to form an opinion as to the recency of contamination. From this point of view a bacteriological examination, which in practice usually consists in a count of *B. coli,* is a better guide, bearing in mind that the only legitimate inference to be drawn from analysis is the relative liability of the effluent to be a carrier of pathogenic organisms. It is a cardinal blunder to suppose that analysis informs one as to whether a water is dangerous as such, that is, by reason of its chemical composition. Analysis can only indicate the degree of probability of contamination by such pathogenic organisms as are water-borne. There is nothing whatever in a chemical analysis to indicate danger of poisoning. Because an effluent or a stream water contains "albuminoids" it is misleading to describe it as "deleterious" or "unfit for cattle to drink." It could, however, be rightly described as potentially dangerous for human consumption, in consideration of the fact that the high albuminoid points to comparatively recent contamination, which may contain pathogenic organisms. The question as to whether human sewage can be the vehicle of organisms dangerous to stock is vital to the issue and falls for discussion by my bacteriological and pathological colleagues.

In illustration of the general nature and significance of analysis I quote from the mass of available data, a typical analysis of a crude sewage above the average strength and of the effluent therefrom, for which I am indebted to my friend Dr. J. F. Beale, a gentleman of wide experience in the examination of these liquids.

	Crude sewage.	*Effluent from this sewage.*
Appearance	Dark grey sewage sludge.	Bright with flocculent deposit of humus.
Colour	Dark grey.	Yellow.
Odour	Sewage.	Earthy.
Suspended matter	31·2	2·8
Volatile matter	24·0	2·1
Chlorine	22·0	15·8
Nitrites	nil.	nil.
Nitrogen as nitrates	nil.	0·06
Free ammonia	3·560	1·650
Albuminoid ammonia	1·140	0·072
Oxygen absorbed from permanganate in 3 hours	36·80	0·78

The figures give parts per 100,000.

Analytical figures serve to emphasise the rise in nitrates at the expense of combined nitrogen, and the fall of oxidisable matter (organic matter), as shown by the values for volatile matter and oxygen absorbed.

It will be agreed that the chemistry of sewage presents a veritable moving picture, of which we know the end points—nitrates, carbon dioxide and water; we know a little of the starting points (composition of dejecta); but we know little or nothing of the intermediate steps beyond that they are labile or fugitive substances of the nature of amino-acids, ammonia, etc. We are amazed at the rapidity and completeness of these fermentative changes in comparison with the intricate and tedious processes which would be required to obtain the same end by purely chemical means. The figures also ought to serve to impose a due sense of proportion in expressing any opinion as to the possible toxicological significance of the substances disclosed. For instance, in the examples selected, albuminoid ammonia in the sewage works out at eight grains in a ten-gallon water ration, and in the effluent at half-a-grain in the same ration.

It should take a very bold man to claim that such minute doses considered in relation to the relatively vast mass of ingesta in the herbivorous tract could possibly either be poisonous or predispose to injury or malnutrition. The characters of the changes undergone by food in the bovine are similar in general to the changes encountered in the human tract, and it is sheerly impossible to suppose that a minute addition of products of human origin to the alimentary contents of an ox can make any difference whatever.

It is deplorable that some analysts assert, on the grounds of analysis, that a water is dangerous, or deleterious, or unsuitable for cattle to drink, even going so far as to suggest that a contamination of human is more dangerous than one of bovine origin.

Having regard once again to their origin and general character, it is puerile and grossly evasive, when challenged to specify any particular agent, for such a person to take refuge in generalities such as that although it cannot be said that any particular component is harmful, the components taken together are so.

One trusts that it is not too much to ask that some analysts will make a serious effort to remind themselves that the true object of water analysis is to disclose the liability to pathogenic bacterial infection. Nobody will deny that analysis may prove the liability of a water carrying, for example, the bacteria of typhoid or cholera, which after ingestion may multiply and cause illness. Allowing that as from man to man a grave danger may exist, it is open to discussion as to whether any danger of bacterial infection exists as from man to cattle.

One may sum up by saying that all we know of its chemical nature and the physiology of digestion negatives the probability of sewage being poisonous. Allowing, however, that one is dealing with unknown substances, the final answer can only be given by a test. But no test is of any value if as in most field tests, which afford the basis of most allegations of damage, more than one independent variable is altered at a time. Granting that rough and ready experience in the field may warrant a case for enquiry, the issue must be tested with full regard to the essential logical and scientific conditions, which must govern any such test, if it is to be of value.

General Discussion

The general discussion on the foregoing addresses was opened by Dr. F. C. Minett, who said he had been left wondering why it had been decided to hold the discussion. On getting notice of it, he at once thought of the Loch Ness monster and had concluded that the monster in sewage must be similar in nature to that which existed in Loch Ness. (Laughter.) No doubt the matter would not have been discussed at that time, had it not been for the recent law case.

On the question of what the alleged poison in human sewage was, no one had been able to provide a definite answer. There was no solid reason for believing that it was bacterial and, as Dr. Lander had said, there was no chemical substance in sewage which could be looked upon as poisonous. It would perhaps have been a useful demonstration if someone had produced a bottle of the effluent at the present meeting. It was a faintly opalescent liquid, with a very slight

earthy odour and yielded quite a small deposit on centrifuging.

When they were first approached at the College regarding the impending law case, it was suggested that the best way to settle the matter would be to carry out an experiment on cattle. It was not expected that the experiment would extend beyond three months, but, as it turned out, the three animals under test were dosed with sewage for a period of 21 months altogether. Further, one animal drank nothing but undiluted effluent for a period of eleven months, not for one or two months as stated by Mr. Pugh. In that connection he would like to quote Mr. Levie who, in a publication, had stated that an animal which drank crude effluent for six months would die. He would also mention that the other two animals received for a part of the time, in place of effluent, diluted sewage prior to its final purification. During the experiment the animals thrived normally, although they received only a maintenance diet. There was no need to go into the matter further, because an article by Professor Wooldridge, Dr. Sheather and himself, giving full details of this experiment, with literature references, had been prepared for publication. [*Vide* commencement of this issue.—Ed., *V.R.*] He had carefully gone through the available literature and the impression was that the possibility of sewage having poisonous properties for domesticated animals never appeared to have entered the heads of sanitarians, who had no special interest in animal disease. There were references, however, to cattle living on sewage farms and consuming sewage without harm, as Dr. Stableforth had mentioned, and the milk of such animals was sold for human consumption.

On the other hand, if sewage did not cause damage, what did? The reasons might be dietary or due to disease. With regard to disease, worm infestation had been mentioned and so had Johne's disease. Mr. Pugh, in speaking of the mortality from Johne's disease, was referring to something quite different from what was claimed by certain witnesses for the defence, including the speaker, in the recent action. There was no dispute that the great majority of cattle died once they had reached the clinical stage of the disease as the practitioner was accustomed to see it. It was certain, however, that the disease in affected herds was not confined to animals which showed clinical signs and that animals in the latent stage of the disease might become unthrifty and lose flesh owing indirectly to environmental causes, and afterwards improve when placed under better conditions.

Dr. Minett thought that the lesson to be learned from all this was the necessity of forming an accurate diagnosis. In attempting to do this, every possible means should be employed.

Dr. W. R. Wooldridge said that he found himself that night speaking rather on the side with which he was not really in sympathy: the reason for that was that it was quite obvious, from the discussion they had had thus far, that the pendulum was swinging round in a direction which, to his mind, it was not yet scientifically justified in doing. So far, he thought, they would all draw the conclusion that sewage could not be poisonous to cattle: he contended that there was little or no decisive evidence one way or the other.

Dr. Lander had described to them the main constituents of crude sewage. He had emphasised the point that a large proportion of the solid matter in sewage consisted of bacterial bodies, the majority of which were dead cells. He then referred to the fact that commercial sewage contained a large variety of chemical substances, which, however, were only present in very small concentration. It was unfortunate that the term "-crude sewage" had been used by Dr. Minett in a sense which was not justified. In sewage work they only referred to "crude sewage" as being the sewage which contained a much larger content of organic matter than that which was found in the sewage that passed through the filters, *i.e.*, in the sewage of the sedimentation tanks or of the sewers. He did not think that anyone could hold that the final sewage effluent or the effluent from *efficient* filters was poisonous: the amount of solid matter in it was practically negligible, the nitrogen was present almost entirely as nitrate and the number of bacteria was relatively very low. An individual suggesting that an effluent from a sewage farm was poisonous could only bring such an allegation against a plant that was defective; in the case referred to that night it would appear that the filter beds were not, in fact, renewed as they should have been. If they had got crude sewage, such as Dr. Lander had described, going through into the drinking water, it seemed to him that it was possible—although he thought it most unlikely—that poisoning might be brought about by such sewage. To begin with, they could look at the matter from the chemical point of view. Chemically, he agreed entirely with Dr. Lander that it was not likely to be poisonous; the substances in ordinary domestic sewage were present in too low a concentration. Bacteriologically, however, he thought they were without any evidence whatsoever from which they could draw any conclusions at all. To begin with, if crude sewage were present the bacterial count could be very high, and consisting, as it did, of coliform organisms, streptococci and even a large number of anærobes of the welchii type, it was not certain, without experimental work, that no harmful effects would follow ingestion of such material. They all knew that one of the common channels for voiding pathogenic bacteria from the human or animal was *via* the fæces; therefore, if a proportion of raw material of the farm was obtained from individuals infected with or carrying pathogenic organisms, there would be a correspondingly large proportion of pathogenic organisms present in the sewage. The task of proving that such organisms pathogenic for man were also pathogenic for animals was a matter for experiment. Really, it came to this, that if they wanted to prove a case of sewage poisoning against a sewage farm, they would have to prove, first of all, that crude sewage actually gained access to the effluent, and then, if they were working on the bacteriological side, that there were bacteria in that particular sewage that were pathogenic to cattle.

There was another point of view, which was that of a bio-chemist and which might not have anything whatever in it, but which, nevertheless, was a possibility that should be considered. It had been shown recently that not only the living organisms but even the large amount of dead cells in sewage were intensely active enzymically, especially as a system using up oxygen. That was the reason, to a large extent, why sewage was poisonous to fish; the bacterial cells (dead and living) were turned out into the river in association with small quantities of chemical substances which, although inactive chemically, formed suitable material for the active enzymes of the bacterial cells to work upon, and as a result of the dual presence of enzymes and chemicals all the oxygen, or a large proportion of it, was removed from the water and the fish

died. He suggested to them that it might be possible for an animal that had swallowed large quantities of crude sewage in its drinking water to suffer from the presence of such an active oxidation mechanism in its alimentary tract. Such a mechanism would oxidise certain of the breakdown products, such as amino-acids, fatty acids and sugars, of the animal's food, with the result that over a long period the animal might be getting much less food than it should, and so possibly show signs of under-nourishment. It was also conceivable, although unlikely, that the presence of crude sewage in the upper part of the intestines would result in such complete anærobiosis that some harmful effect might result.

In putting forward these arguments he emphasised that his object was simply to drive home the fact that the case for sewage poisoning of cattle was still arguable, although unlikely.

He felt strongly that a really definite conclusion was not yet possible until further scientific tests had been carried out on that problem. He thought that Dr. Minett, Dr. Sheather and Professor Wooldridge had made a good beginning with their experiment, but the number of animals used in that experiment was much too small to enable any definite conclusions to be drawn from its results.

The other main argument put forward against the sewage poisoning of cattle was that healthy herds of these animals normally lived on sewage farms. It should be pointed out, however, that these animals did not drink crude sewage. They certainly drank sewage effluent, or pasture watered thereby, but, as Dr. Minett had told them, sewage effluent was practically as good as drinking water. In conclusion, therefore, it should be emphasised that whilst his (Dr. Wooldridge's) own view was that, generally speaking, sewage poisoning of cattle did not exist, yet at the present time we were not scientifically justified in concluding one way or the other.

Replying to Dr. Minett, Dr. Wooldridge said that he personally could see no reason why the ingestion of diluted sewage should have a cumulative effect.

Professor G. H. Wooldridge said that it was his intention, on coming there that night, to hold a watching brief only. He had not anticipated that the law case to which reference had been made would have been brought into the discussion at all; he had assumed that they were to discuss the problem on a broad basis without any particular application to any one instance. However, he felt that as the President had permitted those references, and his (Professor Wooldridge's) name had been mentioned in regard to that case, he had no alternative but to return to it himself.

He could not allow some of the statements made by Major Pugh to pass unchallenged. In the first place, he would like to point out to him, in order to clear up that issue, that it was never stated by anybody appearing for the defendant local authority that the cattle that were said to be ill had all suffered from Johne's disease. In regard to Johne's disease, when he saw the cattle he saw some that looked highly suspicious of Johne's disease. More conclusive, however, was the animal that had been slaughtered by the owner of the cattle and had been picked out by his expert advisers as a typical case of sewage poisoning. He was asked to make a *post-mortem* on that cow and he found her to be affected with Johne's disease. There were the macroscopic characters to begin with; in addition, he made a microscopic examination of films from the diseased animal and these findings confirmed his diagnosis. She also was affected with fluke disease of the liver; all other organs were normal. So much for that typical case of sewage poisoning picked out by themselves.

Major Pugh had omitted to tell them that some cattle had been slaughtered under the Tuberculosis Order as cases of advanced tuberculosis on one or both of those farms. It was necessary to tell them what, in the view of himself and others, was the main cause of the condition of those cattle. In point of fact, there were several main reasons and they could be summed up mainly on these grounds: the cattle were being grazed on low-lying pastures which at times were flooded. His hearers would know the type of herbage that grew on those pastures, that it was not likely to be conducive to good conditions. There were cases of Johne's disease present and there were tuberculous animals; there was also fluke disease present in the herd. The statement made by the advisers for the defence was that the bad condition of the two herds was due to a variety of causes. A number of the cattle were in first-class condition; a number were in poor condition, and a number were actually scouring. In the one case in which a *post-mortem* was made the animal was definitely affected with Johne's disease. He advised that one of the herds should be tested with johnin and he recommended that Major Pugh be asked to carry through that test, which he did. His report, to which Major Pugh had not referred that night, said quite clearly that he got a number of positive reactions, a number of instances in which the reaction was doubtful and other cases in which there was no reaction whatever. He went further and took samples of fæces from 37 cattle and sent these samples to Dr. Sheather for examination. Dr. Sheather was able to demonstrate the presence of acid-fast bacilli which he was able to identify as Johne's bacilli, in 15 samples of fæces. With these reports before him, Major Pugh said "Well, we have got these reports, but my opinion is that these cattle are suffering from sewage poisoning." He made no reference to tuberculosis, which had been established by the veterinary officers for the county, who had condemned and slaughtered a number.

They were asked to account, sometimes, for the improvement which occurred in certain cattle when they had had access to certain water, after removal. He thought it was obvious. The cattle in this instance were removed to high-class herbage, and he thought the improvement was due to that and the fact that they were removed from the cattle-sick pastures.

To get back to the principal question: attention had been drawn to the possible difference between cattle having access to water diluted with effluent, *i.e.*, that had been treated in sewage beds, and cattle that had been ingesting crude sewage. He wanted to get back to that crude sewage. One knew quite well that commonly the main method of sewage disposal from the small townships was to collect it at sewage farms, to screen it of the grosser solids and to pour the crude sewage thus obtained out on to pasture land. Cattle were fed on this pasture land and, under such conditions as that, sewage poisoning, according to some people, occurred, and yet no ill-effects were met with. In some districts there was to-day competition amongst farmers for the grazing of such pastures, and surely that would not be the case if it was a source of trouble. Another formerly common method employed for the disposal of the solid matter of human sewage used to be to convey it to a field and bank it up with soil, in which surface pit it would be

mixed with soil, and then used as fertiliser for pastures as well as on arable land. He had never heard of any ill-effects on the cattle as a result of that. He knew, too, of a number of instances in which sewage from farm houses was carried down by waste pipes to the pasture land. Cattle would frequently be seen drinking at that point and no ill-effect noted. With this evidence one could not help being driven to the conclusion that it was not harmful. When one came to the more up-to-date methods of disposal it was beyond his comprehension, from the practical point of view, to imagine that such highly diluted treated material could be in the least degree harmful.

Then it was suggested that the experimental cattle that were watered with effluent from this particular farm were not under natural conditions. Of course they were not. If they were put down on those fields to which he attributed the cause of the trouble would they not be exposed to those same complicated causes that he mentioned on that farm? Surely the correct procedure was to remove the cattle from these possible causes of the trouble, and to give the polluted water a free opportunity to set up that trouble. He thought the only way in which that could have been tested was on the lines they had adopted and referred to by Dr. Minett, and which he hoped they would later see published in *The Veterinary Record*.

He thought that a lot of the misapprehension that trouble occurred through cattle drinking sewage polluted water was based on the findings in the report of the Royal Commission on River Pollution, where it was pointed out that certain pollutions were fatal to animal life. People who read that statement did not read the whole of the report, where it was shown quite clearly that that mortality referred solely to fish life. The cause of the death in fish was the absorption of oxygen from the water; the fish actually became asphyxiated, not poisoned. The reduction of oxygen in the water had no deleterious effect on cattle, which obtained their oxygen from other sources.

He noted that Dr. W. R. Wooldridge had raised another point which was of very considerable interest and, he thought, one which should be investigated, but he felt he had rather begged the question if he would view it in the light of the experience of those who had seen those quantities of concentrated material consumed and also in the light of the very high dilution of the effluents that poured into streams. The experiments that they had carried out at the College showed that that high dilution was not necessary to render the material innocuous. The cattle got no succulent food; the whole of their water supply came from the water they actually drank.

He had no hesitation in saying that pollution of water with normal human sewage, although from the æsthetic point of view it was not to be desired, was not capable of producing any diseased condition whatever in cattle.

Captain R. J. Stow observed that he also took some part in that law case, and he thought one point which had not been brought out at all that night and which was worth mentioning, because it made a considerable difference, should be stated. Those cattle were on low-lying meadows which were flooded in the winter, during which time they had no access to them. During the dry weather the stream into which the effluent flowed from the sewage works became practically dry. The point which occurred to him was that if sewage effluent was poured into the stream for a number of years, and if for a considerable part of that time the sewage works were known not to have functioned properly, what would be the condition of the mud at the bottom of that stream? In the dry weather, when there was practically no water running at all, did the bacteria which had been deposited from the effluent lie there and breed tremendously, and might that not bring on the symptoms which were found in those cattle?

There had also been reference made on two occasions to cattle on sewage farms. His experience might be very small, but on any sewage farm he had known there had never been a dairy herd run, but only bullocks; and they were not given the effluent which came from the sewage works.

The pastures to which Professor Wooldridge referred were not what he would call good, but on the other hand were far from bad, and he knew them well. If those pastures were bad, as Professor Wooldridge had suggested, and affected with those diseases he had suggested, would it not be quite a good experiment to put some cattle on to those pastures and give them the main water supply, and then, if those cattle did not become ill, would it not rather point to it being purely the water which was responsible for the illness of the cattle in the case?

Professor Wooldridge had spoken of the number of cases from which Major Pugh sent up the fæces for examination. He said that of 37 samples 15 were returned as infected with Johne's disease. What percentage would he put down as the usual amount found among cattle on examination of the fæces? Was it not generally rather large?

Dr. Stableforth, speaking with regard to the amount of effluent given to the cattle at the College in the experiment, said that one calf had 760 gallons in 21 months. He thought that worked out at 36 gallons a month; that surely would be nothing like the quantity of water which the animal would consume in the ordinary way. [Dr. Stableforth: "That was, diluted with water 1: 10."]

Personally he felt that the effluent from sewage works, especially if the works were not functioning properly over many years (and he thought that in that particular case they had not been functioning properly), might be entirely different from the effluent which was being taken out of the pipe now, after the sewage works had been improved. He was sure that everybody would welcome any definite evidence either way with which anyone could supply them.

Dr. J. McCunn said that Captain Stow knew that farm very well and also that the sewage works had been repaired, and he would ask, did the cattle now, since the sewage works had been repaired, suffer in the same way as they did when the sewage works were functioning in an unsatisfactory manner?

Captain Stow replied that, to the best of his knowledge, the cattle now had no access to the sewage.

Dr. Wooldridge stated that it was asserted that, since the sewage works had been enlarged, the condition in the cattle was continuing, but not to the same extent.

Dr. Minett observed that the judge in the lower court granted an injunction on the sewage works; he evidently thought, therefore, from the evidence, that the damage was continuing.

Mr. Arnold Spicer said that that case arose out of a chain of cases, the first being brought by a farmer [named] against the sewage works. He (the speaker) was his veterinary surgeon, and up to 1927 the sewage was admittedly bad and in

that year they started altering the works and the sewage effluent was consequently improved from 1927 to 1929. During the whole of that time there was no question of disease other than the ordinary farm cases. He was there frequently and he maintained that there was no case that could be regarded as one of sewage poisoning. At the end of 1929 the farmer had two cases which he told him were cases of Johne's disease. He (Mr. Spicer) made a *post-mortem* on one case and the findings were typical. He believed there was another case in which Sir John M'Fadyean was called in and made a *post-mortem*, returning Johne's disease as the finding. In his (Mr. Spicer's) case, the owner changed his veterinary surgeon and the latter told the owner that the condition was sewage poisoning. The last veterinary surgeon knew the place for three or four months, but he had known it for 15 years.

Mr. Spicer challenged the statement made by Captain Stow about the stream running dry; before it reached the two farms mentioned a second stream ran into it and consequently the stream was never dry. This season had been an exceptionally dry one and yet there had been plenty of water in the stream below the sewage farm.

Having seen those cases right through, he could not agree that the condition was one of sewage poisoning.

Professor J. G. Wright said that he proposed to say a few words, not on sewage, but on the sidelight on the discussion—Johne's disease. Their views upon this condition would have to undergo considerable modification. That Johne's disease was generally regarded as very serious was evidenced by the fact that quite recently Divisions of the "National" had been invited to discuss whether the time had not arrived when Johne's disease should be made notifiable, because of the danger of spread arising from the clinical case. It was held by some that we were not even justified in treating the disease. That evening both Johne's disease and parasitic gastro-enteritis, both highly fatal diseases, had been mentioned.

Fæces from 37 cattle were examined, and in 15 organisms said to be positively those of Johne's disease were isolated. This was interesting, because in several cases in which animals had died of the disease and in which the changes in the intestine were typical of the condition, pathologists had told him that they had great difficulty in isolating the organism from the lesions.

The johnin test had been mentioned. He (Professor Wright) did not accept this as an accurate diagnostic.

The point of interest was that Major Pugh had stated that these cattle, which were eliminating the organism in their fæces, were alive and apparently well two years later.

Professor Wooldridge said that the fact that he only pointed out three cases of clinical Johne's disease did not quite carry with it the interpretation that Professor Wright had put upon it. Animals might be eliminating Johne's bacilli without showing any clinical symptoms whatever of the disease. That was an established fact; that a number of animals with that condition might improve was also an established fact, but that cases of clinical Johne's disease would come round in that way, while again an established fact in one or two experimental cases, was so problematical that he felt that it would not be desirable to treat such cases, which were a potential source of trouble.

Dr. Fred Bullock said that the question at issue in the case quoted that night was: "Was the council responsible for the condition of the cattle?" The defence had nothing to do but to wait until the plaintiffs had proved their case. Lord Justice Scrutton's judgment was very lengthy, but what he really said was: "I have come to the conclusion that the plaintiffs have failed to satisfy me that the cattle have been damaged by the effluent; therefore this appeal must be allowed." Lord Justice Slesser said: "This appeal must be allowed solely on the grounds that the plaintiffs have failed to show that the effluent, however much or little human sewage was in it, has poisoned their cattle." Earlier in his judgment Lord Justice Scrutton had said: "But the mere fact that the cattle became sick when drinking at the stream, and recovered when taken away from it, even assuming that the stream was polluted, as alleged, does not necessarily prove that the pollution was the cause of their sickness." He (Dr. Bullock) thought that was the most important observation made: the question was: "What was in that effluent that caused that condition?" and on that point there had cropped up in the court, as there had cropped up that night, the fallacy that because one thing happened after another therefore it was caused by that first thing. Because the cattle that were drinking at the stream recovered after they were taken away from it was no proof whatever that it was the drinking at the stream that was the cause of the condition.

If veterinary surgeons would limit their evidence to the point at issue it would rob the lawyer's pockets of enormous fees and might indeed reduce the amount of veterinary fees, but in the interests of truth and justice it was important to limit the issue to the one question: "Where are the proofs that that condition was due solely to this cause?" and until those proofs were supplied by the plaintiffs the defendants could sit still and say nothing.

Dr. J. McCunn observed that he had been interested in one or two cases of so-called sewage poisoning, and he might say that his view was that human sewage was not harmful to cattle. For any animal to be injured by accident or disease there must be a cause; was there anything in the bacteriology of human sewage that was poisonous to cattle? Humans often drank quantities of *Bacillus coli* without any harm, as they could all sorts of things. To cause them harm they had to drink something which would cause a specific disease, and in all those cases he had never heard of cattle drinking anything which would cause a specific disease in cattle, such as Johne's bacilli, tuberculosis bacilli, or even abortion germs. It was a well-known fact that we could eat our own healthy excreta or anybody else's without coming to any harm whatsoever other than nausea. Before they could prove that animals suffered from drinking sewage they had to get down to bed rock and prove some bacterial, chemical or organic cause; they had got to get some indication from the analysis that there was some specific factor at work. Thereafter, as Dr. Minett and Dr. Sheather had tried to do, it was necessary to conduct a test in order to prove the facts again, because you could not take one case as a decisive one—it might be just a coincidence.

The question he put to Captain Stow might have had some influence, because he bore in mind the fact that there was such a thing as worms; the worms of the alimentary tract affected the cattle and they also excreted into the alimentary tract. He had been told by pathologists that dogs which suffered from worms and died, died from toxæmia due partly to these

worms and to absorption of the excretions from these worms. Was it not possible that this might give them a line of research—that these parasites and their products of excretion might set up some kind of toxæmia which up to the present they were not able to identify or indicate by any of the present means?

In conclusion, he would say that he was absolutely convinced that, in the light of our present knowledge, human sewage caused no harm whatsoever in cattle.

Sir Arnold Theiler said that he had primarily come to listen, because the subject which was brought up for discussion interested him very much; it was very important from the practical point of view, and was not without scientific interest.

Personally, he had no experience with sewage, but he had frequently seen on the veldt in South Africa instances, particularly in times of drought, of cattle collecting around water holes to drink, into which they passed their excrements, with the result that they were practically consuming their own sewage. Yet he was always struck by the fact that nothing happened to these animals. Under these circumstances diseased conditions were only expected when the animals were suffering from worm infestations, which could be spread in this way, leading to loss of condition, anæmia and cachexia, from which the animals might recover after being put on to good pasture. With the exception of the references made to it by the previous speaker, he had missed that evening a discussion on verminosis as a possible explanation of the disease under discussion, although the presence of flukes had been mentioned.

With reference to Johne's disease, he had had very little experience. In South Africa he had observed Johne's disease only in imported cattle from England. He had, however, heard of one or two cases, which were said to have originated in locally-bred cattle. He certainly was not aware of its spreading in South Africa. He wished, however, to point out that he was firmly convinced, from a general pathological point of view, that not all cattle that were infected with Johne's disease died. There was a time when we were taught that "glanders was incurable," but the experience since then had shown that there were glanderous infections which would recover. Some attempts were even made at immunisation. When, however, glanders was diagnosed from the usual clinical symptoms, then it was certainly an incurable case. What about tuberculosis? If tuberculosis could be diagnosed by a simple inspection of the animal, they knew that there was no hope of recovery, but there were many cases of cattle suffering from tuberculosis which eventually recovered.

He understood, from Dr. Stableforth's paper, that the bacilli present in sewage were of the *Bacillus coli* type, Streptococci and perhaps also *Bacillus welchii*. Were these also present in the fæces of cattle? [Dr. Stableforth: "Organisms of the same variety are present in cattle."] Then they must be present in the living animals in greater concentration than in the sewage, and their enzymes or toxins must be constantly absorbed. Yet they did not know of a disease in cattle which could be explained as the result of the presence of these bacteria in the intestinal canal. They knew of coli infections occurring in very young animals.

He agreed with Dr. Minett that no evidence for sewage poisoning in cattle could be found in the literature, and he did not remember having seen any reference to it in German or French publications. There existed no evidence that a disease existed which was brought about by the consumption of sewage. It would have to be a specific disease due to the presence of a specific agent of which the sewage would be the carrier or in which it would breed.

Abstracts

[**Undulant Fever.** Dalrymple-Champneys, Sir Weldon. (1934.) *The Lancet, 226,* 5759, 95-97.]

With no desire to exaggerate the importance of undulant fever or to pretend that it is as great a scourge among us as, say, tuberculosis, it must be said that the disease causes a great deal of suffering and misery to its victims and occasionally even proves fatal.

The incidence of the disease in this country is not known, but since the author wrote his report for the Ministry of Health in 1929, the improvement in diagnosis has been reflected in the increasing number of cases which have come to his notice. His whole series comprises 198 well-authenticated cases of endemic origin, with an *average* agglutination titre of about 1 : 1,600. In this series there were five deaths, and the average duration of the fever—apart from a convalescence, which was often prolonged—was about eleven weeks.

Sir Weldon now concentrates on the part played by milk in the conveyance of undulant fever, introducing, by an historical survey of the microbiology of the disease (well known to *Record* readers), a consideration of the question: "What evidence is there of infection by cow's milk in the human cases of which we have records?" He has particulars of this kind relating to 147 cases in his series. Of these, 141 were consumers of raw milk, and two of these drank "Certified" milk, three "Grade A (T.T.)" and four "Grade A." One of these "Certified" milks and two of the "Grade A" were shown to be heavily infected with *Br. abortus*. In 45 of the total of 141 cases, either the herd was known to be suffering from contagious abortion, or/and agglutinins for *Br. abortus* was grown from the milk, or/and agglutinins for *Br. abortus* were found in the milk, blood, or both, of the cows. In seven of these cases, however, the patients had been in direct contact with infected animals, so that, if these seven cases in which direct contact may have played a part are deducted, there remain 38 patients who drank raw milk which was probably or certainly infected, and who are believed to have had no contact with infected animals, and 96 cases in which raw milk or cream had been drunk and there had been no known contact with infected animals, but in which there was no confirmatory evidence of the infection of the milk.

It would appear, then, that while cow's milk is far the commonest source of infection in this

country, other possible sources must also be considered. In this regard, Sir Weldon treats of the other dairy products and also of common domestic animals apart from bovines. In some instances there is definite evidence warranting incrimination, but its extent cannot yet be assessed.

Returning, then, to milk, and remembering that nine of the cases in the author's series drank graded or designated milks, safety can only lie either in not drinking milk at all, or by only drinking milk (or cream) from abortus-free herds, or by consuming only pasteurised milk and cream. The last is obviously the best, in the present bovine abortion position (absence of compulsory notification, etc.), for, properly carried out, pasteurisation kills the *Br. abortus* with certainty; in fact, far more easily than the tubercle bacillus.

One question which must occur to anyone who studies this disease is why there are apparently so few cases of undulant fever when such a large proportion of the milk supply contains the causative organism. The answer is not easy to give, but, says the author, there are certain points worth noting in this connection. In enumerating these, he gives pride of place to the "strong probability" that the cases of which he has records represent only a fraction of those which actually occur in this country, supporting this contention with an interesting excerpt from a letter recently received from Miss Alice Evans who, in 1918, in America, demonstrated the very close relationship which exists between the *Bacillus abortus* (Bang) and the *Micrococcus melitensis*, as these organisms were then termed. Miss Evans writes:—

"Your conviction that many cases in your country pass unrecognised agrees with my conviction in regard to the disease in this country [the U.S.A.]. . . . I am convinced that there must be a great deal of ill-health due to the chronic type of the disease, and these cases practically never receive a correct diagnosis."

Sir Weldon's remaining points are (1) that it is almost certain that infection resulting in immunity can occur without a recognisable clinical disease; (2) there is a possibility that the majority of bovine strains in this country have a low pathogenicity for man, and that thus individual susceptibility plays an important part; and (3) that a lowering of the individual's resistance, due to some other cause, opens the door to infection.

Undulant fever should not be regarded as a last resort in diagnosis, but as a definite possibility in all cases of irregular or prolonged fever.

W. B.

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[Milk Pasteurisation. Wright, N. C.]

At the recent meeting of The British Association at Leicester Dr. N. C. Wright, Director of the Hannah Dairy Research Institute, made a useful contribution to a discussion on "Milk Production and Distribution." This contribution has now been published in a separate pamphlet entitled "Some Implications of Compulsory Pasteurisation." The paper consists largely of a statistical analysis of the result of the introduction of compulsory pasteurisation upon various aspects of milk production, the material for the examination coming from other countries where pasteurisation is already compulsory and from large towns in this country, where it is largely practised. The following conclusions were arrived at:—

Pasteurisation is not the *raison d'être* of the wholesale trade or of the large distributor: it is a necessary adjunct to the rapid expansion of the liquid milk-shed into areas far removed from consuming centres.

Although from 25 to 80 per cent. of the milk supply of certain British cities is already pasteurised, there has been no adverse effect on the producer's price. Further, it seems reasonable to assume that, with the increased consumption of milk which should result from enhanced public confidence in its safety, the producer will, in the long run, secure material benefit from the adoption of compulsory pasteurisation, particularly if he makes certain of securing his share of the benefit by adopting collective bargaining.

The elimination from large cities of the casual producer-retailer, who generally leads to lowering of milk prices, would probably be one of the advantageous results of compulsory pasteurisation.

The long-established producer-retailer would become the chief purveyor of high-grade raw milk from tuberculin-tested (and presumably abortion-free) herds.

As regards the small dealer, if he is already an uneconomic unit, and therefore merely a screen to preserve a high retail price for liquid milk, his elimination will be advantageous to the consumer. If, on the other hand, he can, by installing small-scale plant or by co-operating in the installation of larger plant, compete with larger dealers, he would be relatively in no worse an economic position under compulsory pasteurisation than he is at present.

Recent work demonstrates that clean methods of milk production exert a great influence on the suitability of milk for pasteurisation, while dirty methods of production lead to serious difficulties in the subsequent heat treatment. There appears, therefore, to be no justification for assuming that compulsory pasteurisation will inevitably result in a setback to clean milk production.

It is impossible, in the light of the figures studied in the pamphlet, to accept the contention that pasteurisation is necessarily antagonistic

(*Concluded at foot of column* 1, *page* 168.)

Annotation

The New German Legislation prescribing Measures to be taken for the Relief of Pain in Animals subjected to Surgical Operations, particularly Castration.

Readers of *The Veterinary Record* will recall the considerable prominence that was given a few weeks ago in our daily press to the legislative measures which the present central Government in Germany declared its intention to institute for the control of experiments upon animals. At first it seemed that the purpose of Government was to abolish experiments on animals altogether, and so bring to a sudden end the means of pathological research, in which pursuit for over half-a-century Germany had contributed a massive and glorious share to the sum total of knowledge that we now have derived upon the subject. The suppressive effect of the originally published measures was, however, afterwards mitigated, apparently when their full significance was realised, to give place to the revised measures later published, in which the freedom of action previously enjoyed by those who had wished to use animals for experiments was, nevertheless, drastically curtailed. As reflecting what seems to be another phase in the activities of a powerful humanitarian movement now gathering force in Germany and the influence it has gained with the present lawgivers of the country, our readers will receive, we are sure, with deep interest the information contained in the German weekly veterinary periodicals for the week ending January 27th last upon the nature of the legislation that has recently been introduced in that country to prescribe the conditions for undertaking certain common surgical operations on animals: such operations, and notably castrations, must henceforward be performed with expert skill and under narcosis, where this is deemed necessary.

The information referred to above in the German journals is contained in a short report (the text of which we reproduce in almost literal translation) drafted by a special meeting of eminent clinical professors from the veterinary colleges and faculties of universities. The meeting was convened by the German Veterinary Council ("D.V.R.") and its members sat under the presidency of Professor Stang (Berlin) on January 11th, 1934. The members comprised Professors Hinz, Schoettler and Silbersiepe, of Berlin; Professors Küst and Pfeiffer, of Giessen; Professors Götze, Hinkels, Hupka and Völker, of Hanover; Professors Berge, Reinhardt, Richter and Weber, of Leipzig; and Professor Westhues, of Munich. The report defines the attitude taken up by these experts towards the regulations contained in the new Reich Law for the Protection of Animals, in so far as they prescribe the nature of the methods that must be adopted, when the Act was to come into force, to produce insensibility to pain in animals during surgical operations, particularly castration.

I.—In a general introduction, it is said that the above law was published on November 24th, 1933, and its provisions, with the exception of those regulating the docking of horses, were to come into force on February 1st, 1934. The Law gives effective expression to public feeling underlying the movement in the country for the protection of animals such as it has come about through the prolonged activities of organisations concerned with this endeavour. The German veterinary profession, upon whom the treatment of sick animals naturally devolves, declares itself grateful to the Reich Government and to the public, to whose initiative the new measures came to acquire the force of law, for the legislation in view of its paramount ethical and educative value.

In Section II, §§ 7-9, it is decreed that all painful interventions upon animals and certain operations in particular must be executed in conditions in which the animals are rendered insensible to pain.

There devolves upon the German veterinary profession, it is felt, a highly onerous duty in fulfilling the obligations placed upon it within the meaning of the law. Of set purpose, as also in the due prosecution of their calling according to their Leader's example, members of the profession must become vividly conscious of the high moral obligations that the provisions of the law place upon them.

So far as veterinary science is concerned, especially in regard to those workers in the calling who are specially engaged in veterinary surgery, obstetrics, and small animal practice, it is claimed that the stipulations contained in the law regarding the performance of operations by painless methods have long been in actual observance, dictated as they have been by humane motives; this is evident from the marked improvement that has been achieved in quite recent years in the methods for assuring either general or local insensibility to pain and the increasing variety of methods that have become available. Hence the profession already has acquired the experience which enables it to guarantee that no technical obstacle stands

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to disease eradication. The real fact appears to be that the extent of disease eradication is largely—if not entirely—dependent on the measure of active assistance which is provided by the State. In the United States and Canada, where disease eradication is heavily subsidised, a remarkable measure of success has been achieved. In Great Britain, where State assistance is entirely lacking, no material progress has been made. W. R. W.

in the way of its observing the legal enactments. And, in this connection, it is emphasised that the German Veterinary Council has anticipated by its endeavours these enactments by instituting post-graduate courses of instruction for veterinary practitioners in which the subject of relieving pain by the newer methods during operations has specifically received attention by theoretical explanation and practical demonstration. This endeavour has been further pursued by the Council inasmuch as special courses of study can now be undertaken for the purpose of gaining proficiency in the methods of general and local narcotisation.

Of decisive significance to German veterinary surgeons is the provision enacted within the new law that the castration of certain animals is to be regarded explicitly as an operation only to be undertaken when steps have been taken to procure insensibility to pain.

Section I, § 9 of the Act provides as follows:—

> "No operation likely to cause pain shall be performed in an unskilful manner upon an animal or without inducing in the animal insensibility to pain. Castration is to be regarded as an operation likely to cause pain in horses, in cattle and pigs over three months old, and in sexually mature rams and he-goats. Measures to produce insensibility to pain need not be adopted in operations where the pain is only trifling or where in similar operations upon human beings such measures are not usually employed or where in isolated cases they are deemed by skilled veterinary opinion to be impracticable."

In the statement of objects published by the Reich Ministry of the Interior in the Reich and State Advertiser (No. 281, of December 1st, 1933) the following explanation is set forth (§ 9):—

> "Operations likely to cause pain in animals, *e.g.*, castrations, are frequently performed in country districts by unskilled laymen with the use of obsolete procedures and without adopting methods for rendering the animals insensible to pain. Thereby gross cruelty to animals cannot be avoided. It is therefore in accord with the feelings of the movement for the protection of animals that all operations likely to cause pain shall be undertaken only after steps have been taken to bring about insensibility to pain and in a skilful manner. In addition to such measures of narcotisation, all precautions observed in executing modern methods of wound treatment must be adopted, as also skill and care in the manner of casting the animal when this is done.
>
> "The provisions of the Act in this respect are restricted to horses, cattle and pigs over three months old, and sexually mature rams and he-goats, because in the young of the last-named four species the sexual organs have not developed fully when the animals in question are under the prescribed age, and so sensitiveness to pain has not yet become pronounced in them; further, the practice of castration invariably in conditions demanding the induction of narcosis is likely still to be beset with economic difficulties.
>
> "The application of methods for the diminution of pain is unnecessary in the case of operations where, in the opinion of the veterinary surgeon, the intervention is likely to be of very short duration (*e.g.*, opening an abscess), or where in the same or similar operations on the human subject (*e.g.*, stitching of wounds) these methods are not usually employed, or where in rare circumstances (*e.g.*, emergency operations) their application does not seem to be practicable in the opinion of the veterinary surgeon. In the last-mentioned cases, an endeavour ought to be made to alleviate pain, so far as this may be possible, by employing some agent that rapidly decreases pain."

That castration is to be regarded as an operation in which measures for securing insensibility to pain are to be undertaken is of trenchant significance so far as veterinary practice is concerned. This is, moreover, given prominence in the Act. Therefore, it is expedient—so it is said in the report—before the Act comes into force, for veterinary surgeons to refresh their minds by taking into brief consideration the methods that are available for use in practice for bringing about insensibility to pain.

II. Fundamental Remarks.—Before the actual methods are indicated, some fundamental considerations must be examined. In the statement of objects, already mentioned, emanating from the Reich Ministry it is set forth (Section I, 2) as follows:—

> "In respect to the causes that may evoke considerable suffering or pain, as between the higher and the lower animals a dividing line must be drawn. So far as the higher animals, especially mammals, are concerned, one must take into consideration generally all manipulations that are likewise capable of producing distinct suffering and pain in human beings. But even among mammals the sensation of pain is developed in markedly different degrees. It is most essential that for the separate species of animals research should be carried out by experts to ascertain the intensity of the sensation of pain in different animals and thus supply the prime particulars upon which the details to be prescribed within the law can be fixed."

In the statement of objects covering § 12 of the Act it is finally stressed that the sense of the law must be taken to be:—

> "that stock owners must be safeguarded against any excess of zeal that may become manifest in the movement for the protection of animals and from unrest."

These statements forthcoming from the legislators will serve to indicate the choice to be made among the methods of narcotisation taken under review.

Castration—save in those rare conditions in which there are lesions of the genitalia calling for its application—is purely an utility operation, whereby in the first place the animal upon which it is performed is rendered more fitted for the purposes for which it is reared. It is therefore to be evaluated almost exclusively from the economic standpoint. The castration of animals reared on farms is undertaken primarily for the benefit of the German peasant population, upon whom no perceptibly increased financial burden ought to be imposed by exacting performance of the operation under narcosis. It is emphasised, therefore, that only those methods of inducing insensibility to pain can be regarded as serviceable and applicable which can be undertaken without considerable expense.

The methods selected must be most simple and capable of being carried out without complicated apparatus, which moreover might need the employment of skilled assistance for its manipulation. Further, the method must be harmless towards the animal upon which it is used so that risk of loss through death, *e.g.*, in deep general narcosis, is eliminated; otherwise the system would be likely to cause certainly disconcerting alarm among stock owners. We know, it is said, that every agent that can be used for general narcotisation is a poison, and that the poisoning of the animal in the course of an operation can only be avoided by expert supervision throughout. For such control, there are no trained personnel available in the conditions of practice, so that the general narcotic must not be employed at a dose rate that will induce deep, complete, general narcosis, but rather (it is stressed) bring about a diminution in the sensation of pain. It is further to be borne in mind that if full narcosis is induced in the larger animals several hours may pass by before an animal sometimes becomes sufficiently awake to recover sensation and stand on its feet. Meanwhile, during recumbency, the animal must be kept under supervision and when it gets up usually special help is necessary. Through the necessity for employing assistance and retaining it for a considerable time the cost of castration might increase to such an extent that the stock owner would find it unbearable.

Apart from the above purely economic considerations, a deep general narcosis also need not be resorted to for physiological reasons. In the statement of objects covering the Act it is mentioned in this connection that the sensation of pain among mammals is developed to greatly varying degrees of intensity. How intense these sensations of pain are among animals we are at a loss to know, for want of expression of their subjective states by the animals. We can therefore only make deductions from comparative studies upon human beings regarding the variation in the sensation of pain in individual cases. The report in this respect follows the indications of H. Braun, the distinguished authority on local narcosis. According to him, sensitiveness to pain varies to an extraordinary degree among different human beings. It is influenced by numerous circumstances in almost infinite variety. The outward expressions and manifestations of pain are no guide whatever to the actual intensity of the pain experienced. For the intensity of the pain is dependent to the highest degree upon the mental condition of the individual. A sudden, unexpected, violent injury dealt at the body is not felt as a painful sensation, whereas a pinprick causes alarm when it is not unexpected. Also when the mental activity of the individual is strongly directed elsewhere, especially during excitement, no pain is felt. Strong-willed, intelligent people display the pain felt by them less than do anxious characters. Whole races of people and eras are more resistant to pain than others; uncultured, primitive people are even to-day little sensitive. Northerners seem to be less sensitive than Southerners; town dwellers are more sensitive than a large portion of the country population. Among the newly-born the sensation of pain is feebly developed; it is probable that it is cultivated in later life—even like the other sense perceptions—in varying degrees.

Similar, sharply-divided relations are also to be seen in animals in regard to their sensitiveness to pain. For example, in the horse, age, sex, breed and temperament play a part. Likewise, in the case of a large boar, for example, which displays great excitement when it is forcibly brought out of its sty or cast, a painful operation would not be felt to anything like the extent conjectured by an onlooker who witnessed this kind of exhibition for the first time. That castration also belongs to the class of operations which are perceived by different animals to greatly varying degrees, must be concluded from the behaviour of the animals subsequent to castration. Castrated foals, we note, that are released into their paddock immediately after operation, betray hardly any signs of painful after-effects; the castrated boar walks away from its operation to its trough and feeds. Such instances could be multiplied at random. It may be laid down authoritatively

that the pain felt by the individual animal at and after castration must not be adjudged by the over-zealous representations of a movement for the protection of animals, but only by trained persons, which means, in this matter, veterinary surgeons. From a survey of this kind, the methods called for to diminish susceptibility to pain can be suitably varied.

Detailed explanations upon the use of the several methods for inducing general and local narcosis, to include also the methods suited for operations on the limbs and head, are given in the special courses of instruction to be arranged in the immediate future by the German Veterinary Council in veterinary colleges, faculties of universities, and other places.

III. Methods for Inducing Insensibility to Pain during Castration.—For individual animals the following methods come in question, of which only the bare outlines are given here.

(1) *Horse.*—For foals and colts, castration ought to be performed as a rule in the recumbent position in deep chloral hydrate narcosis. For older entires, particularly for temperamental thoroughbreds and half-breds, in addition to chloral hydrate narcosis, local anæthesia of the spermatic cord is recommended. For the standing operation, light chloral narcosis combined with spermatic cord anæsthesia is to be employed.

For the cryptorchid operation, chloral hydrate narcosis combined with infiltration of the site in the region of the skin incision is necessary.

The castration of mares can be performed in either the standing or recumbent position. For the standing operation, light chloral hydrate narcosis (the dose to be reckoned as fully one-third of the ordinary full dose) is to be administered; or, in place of it, light chloroform anæsthesia may be taken into account. Local narcosis by spinal ("extradural-epidural") inoculation has also stood the test for this operation, the animal becoming sufficiently benumbed in ten minutes. The incision through the vaginal wall and the nerves running through the ovarian ligament (which is withdrawn through the vaginal incision) can be anæsthetised with the aid of a special instrument for injection. The castration of the mare in recumbency ought to be carried out with nothing less than chloral hydrate narcosis. Extradural-epidural anæsthesia conduces towards the easy performance of this operation.

(2) *Cattle.*—Bulls are to be castrated standing with spermatic cord anæsthesia. In castration with the Burdizzo pincers, the subcutis must be infiltrated in a circular zone above the level of contusion. Further, high extradural-epidural anæsthesia can be applied; the solution injected must be employed in larger quantity and lower concentration than ordinarily.

Castration of the cow can be undertaken standing without general narcosis. The vagina can be made insensitive as in the mare by extradural-epidural anæsthesia.

(3) In the ram and he-goat castration can be undertaken with spermatic cord anæsthesia. In castration by the Burdizzo method infiltration of the subcutis must be undertaken as in bulls.

(4) In the boar general and local narcosis comes in question. General narcosis can be undertaken with chloroform, ether, and chloral hydrate (into the ear vein).

In the cryptorchid operation, general narcosis is recommended. Prior to the removal of the testicle the spermatic cord can be infiltrated.

In the sow, general narcosis as in the boar has to be taken into consideration. As a supplementary procedure, the line of incision in the abdominal wall can be infiltrated with a local narcotic agent. The removal of the ovary demands no special anæsthesia of the ovarian ligament.

(5) For dogs and male cats general narcosis or spermatic cord anæsthesia have to be taken into consideration.

For bitches and female cats general narcosis is suited.

(6) In fowls narcosis is not necessary as a rule because of the known insensitiveness of these animals towards painful interventions. In particular cases local narcosis or hypnosis can be applied.

J. T. E.

FAILURE TO NOTIFY SUSPECTED TUBERCULOSIS

Prosecuting on behalf of the East Sussex County Council, in cases in which farmers were summoned for failure to give notice of suspected tuberculosis in cows, Mr. L. G Vinall said the object of the proceedings was not to make an attack on individual farmers, but primarily it was to see if further steps could not be taken to give publicity among farmers to the necessity for their complying with the provisions of the Tuberculosis Order. "It is a matter of very grave importance," said Mr. Vinall, "and it is felt by the County Council that farmers as a whole do not comply with the conditions as they should do, largely in regard to disease of the udder of any cow. Farmers are not expected to be veterinary surgeons or persons possessing a high degree of skill in diagnosing disease. All they are expected to do is to give notice when they suspect the presence of the disease. It costs them nothing to give notice."

Having heard Mr. Donald Johnston, M.R.C.V.S., an Inspector employed by the County Council, the Magistrates at Lewes Petty Sessions inflicted on such of the defendants as were convicted, fines varying from £5 to £8 with costs. "These penalties," said the Chairman, "are intended as a severe warning to the keepers of cows where milk is sold for consumption," and he added "Farmers would be very wise indeed if they would take this caution to heart and act upon it, because there is no doubt we shall have to make the penalties heavier."

N.V.M.A. Divisional Report

CENTRAL VETERINARY SOCIETY

"SEWAGE AND CATTLE" DISCUSSED AT THE CONWAY HALL

Readers should turn to the "General Articles" section of this issue of *The Veterinary Record* for the report of the major portion of the proceedings at the January meeting of the Central Veterinary Society, which was held at the Conway Hall, Red Lion Square, W.C.1, on the eleventh of the month, for there they will find reproduced, with a report of the discussions upon them, the three addresses delivered on the subject: "Sewage: Is it a Source of Poisoning in Animals?"

It was doubtless more with faith that these discussions would prove of exceptional interest than in hope that they would furnish any conclusive solution to this vexed but intriguing question that the Fellows attended in such force. The President (Mr. H. C. P. King) occupied the chair, and there were also present Captain L. S. Balls, Messrs. S. E. B. Balfour-Jones, W. Brown, Dr. Fred Bullock (Hon. Fellow), Mr. H. E. Bywater (Hon. Secretary), Major T. Dalling, Mr. J. J. Davies, Major W. Denington, Major G. W. Dunkin, Messrs. C. Elphicke, J. W. H. Holmes, H. D. Jones, Miss M. G. Jordan, Messrs. Herbert King, F. J. Kinghorn, Lieut.-Colonel G. P. Knott, Captain W. J. Leyshon, Mr. G. H. Livesey, Professor Jas. Macqueen, Mr. M. O. J. McCarthy, Professor Jas. McCunn (Hon. Treasurer), Messrs. H. G. McShane, K. A. Miles, Dr. F. C. Minett, Major-General Sir John Moore, Mr. W. Perryman, Major F. S. Probyn, Major L. P. Pugh, Major S. L. Slocock, Mr. A. Spicer, Dr. A. W. Stableforth, Miss Marian Stewart, Captain R. J. Stow, Major F. J. Taylor, Mr. C. N. Thompson, Sir Arnold Theiler (Hon. Fellow), Mr. F. O. L. Walpole, Mr. R. A. Willett, Professor J. G. Wright, Professor G. H. Wooldridge and Dr. W. R. Wooldridge. In addition, the following visitors were present: Messrs. E. W. Ascoli, J. B. Dier, Miss Miriam Ford, Dr. J. Russell Greig, Mr. F. Land, Dr. G. D. Lander, Mr. T. A. Shaw, Miss T. Somervail, Messrs. S. B. Vine and B. O. E. Walpole.

The minutes of the Annual General Meeting, the Annual Dinner and the December meeting, having received publication in *The Veterinary Record*, were taken as read and were confirmed and signed.

Correspondence.—(1) From Lieut.-Colonel E. P. Argyle, Mr. J. B. Griffiths and Captain J. Smith, of Kenley, apologising for their inability to attend the meeting. Captain J. F. Macdonald also wrote apologising for his absence, and acknowledging with appreciation the letter from his successor in office as Hon. Secretary conveying the vote of thanks passed to him by the Society at its December meeting for his services in that capacity over a long period.

(2) From the Secretary of the National Horse Association of Great Britain enclosing a copy of one of its most recent publications, "The Horse Owner's Guide," and offering to send display cards, pamphlets and copies of a leaflet "Horse *versus* Motor Transport," on request. Enquiry was also made as to the continuance of the Society's subscription of £5 5s.

On the proposition of Professor Wooldridge, seconded by Captain Stow, it was unanimously agreed that the subscription be continued.

(3) From the Secretary of the Royal Sanitary Institute inviting the appointment of delegates to the Congress of the Institute to be held at Bristol from July 9th-14th.

Mr. Jones proposed, Professor Wooldridge seconded, and it was unanimously agreed, that a delegate be sent, and Mr. Bywater (Hon. Secretary) was appointed to represent the Society.

(4) From the Secretary of the N.V.M.A., concerning the Veterinary Advisory Scheme.

The meeting went into committee to consider this communication. Upon the resumption of open meeting, it was resolved, on the proposition of Mr. Livesey, seconded by Captain Stow, that this matter be dealt with by circularisation of the Fellows, who would reply privately to the Secretary.

Nominations.—The following were nominated to Fellowship of the Society: Miss C. M. Ford, 58, Valliers Wood Road, Sidcup, Kent (proposer, Mr. J. F. Macdonald, seconder, the Hon. Secretary); Mr. F. Land, 20, High Street, Bow, E. (proposer, Colonel Rainey, seconder, the Hon. Secretary); Mr. B. O. E. Walpole, "Burleigh," Cromwell Avenue, Highgate, N.6 (proposer, Sir Frederick Hobday, seconder, Colonel T. Dunlop Young).

Elections.—The following elections to Fellowship were made: Mr. J. Y. Bogue, Royal Veterinary College, Camden Town, N.W.; Mr. A. B. McIntyre, Langley Court, Beckenham, Kent; Mr. J. Bedlington Griffiths, Blenheim Lodge, Waterden Road, Guildford, Surrey; and Mr. T. A. Shaw, 156A, Brixton Hill, S.W.2.

MORBID SPECIMENS AND CASES OF INTEREST

Mr. H. D. Jones exhibited a keratoma and the pedal bone, the latter showing clearly the indentation caused by the keratoma. This condition, said Mr. Jones, was a very familiar one to practitioners with experience of horses, but he thought it would be of interest to the younger members.

Captain L. S. Balls exhibited the tumoured spleen of a dog. This dog, which was six or

seven years old, had been ill for about three months when it was brought to him, when he felt the growth in the abdominal cavity behind the ribs. X-ray pictures were taken, and in these (exhibited) they could see the dark mark showing the position of the tumour. Dr. McCunn saw this case, and wanted to perform an exploratory laparotomy. The owner, however, would not consent to this, and the dog was destroyed.

Continuing, Captain Balls said that he had there three worms, taken from a monkey. About a month previously this monkey, which was a West African "woolly nigger" monkey, showed signs of indigestion; it was given oil of chenopodium, and it passed nine worms a foot long. They dosed it again 15 days afterwards, and it passed some more worms the day previous to the meeting. He wondered if those worms were of the same type as those from which children suffered, or whether they were of the type harboured by the dog.

Professor G. H. Wooldridge had a specimen there which, he said, was not an uncommon one, but the history of the case was interesting and a similar occurrence might cause trouble should the owner be less reasonable than the owner of this particular dog proved to be.

The subject was a red setter, three or four years old, and was a patient of Captain Balls. It was affected with skin disease, and was brought to the College for a second opinion as to the nature of the skin trouble. There were eczematous patches in various parts of the body and in front of the right carpus there was a little channelled lesion which they thought had better be opened and cauterised. Scrapings proved negative for acari and the dog was returned to the owner's representative, and they promised to ring up Captain Balls and discuss the case with him. The dog was taken from the College by "tube" to South Clapham, and when it got out of the "tube" it was apparently quite healthy and lively, and pulled vigorously on the lead. However, when it had gone about 400 yards, it suddenly dropped dead without any warning. The owner got on the 'phone to the College, and they expressed great surprise and said they would like to make a *post-mortem*. The dog was brought back, and on *post-mortem* some comparatively recent lesions of the valves on both sides of the heart were found, being most noticeable on the left side. The valves were distinctly thickened, but there were no deposits and the lesions looked comparatively recent. The remarkable thing was that, on making enquiries of the owner, they were informed that the dog had never previously exhibited untoward symptoms of any kind. Those cases of sudden death, under such circumstances might, of course, have very serious consequences.

Continuing, Professor Wooldridge said that actually on the same day that that occurred he was to go to the Zoological Gardens to see a parrot that was, apparently, in perfect health. The owner was proposing to send it abroad and a certificate of health was required for that purpose. Accordingly, he arranged to go along to see it next day. Between eleven and twelve that day, however, a 'phone message came through to say that it was unnecessary for him to go as the bird had died during the night. He could only congratulate himself that death had occurred on that night and not on the next.

Those two sudden deaths, occurring on the same day, struck him as rather a remarkable coincidence.

Mr. H. D. Jones observed that as Professor Wooldridge had alluded to cases of sudden death, he should like to mention one that had happened only that morning. Two horses were on the ride to the stables above. One animal had just started going up when he suddenly squealed, reared up and fell off the ride, but got up again and recovered. The second horse was coming down and suddenly dropped dead. Electric shocks could be felt on the wall at the side of the ride and it was found that there was a loose electric wire, connected up to the girders under the ride.

Mr. A. Spicer exhibited a calculus from the bladder of a dog, saying that he did so because of the tremendous size of the calculus and of the remarkably young age of the dog, which was less than two years old. He had now been in practice at Oxted for 32 years and he had seen from 12 to 15 cases of calculi in the bladder, of different sorts, and they had all been from dogs which had come from distant parts. The Oxted water was very hard and consequently it was somewhat peculiar that there should be an entire absence of calculi in the dogs of that district.

Lieut.-Colonel G. P. Knott exhibited some X-ray photographs of a well-known racehorse, named Gay Devil, which last February fractured his off hind pastern. This was put in plaster of paris and the horse was turned out until August. Two months ago he was sent down to the sea. He now heard that the horse was going practically sound and was doing fast work. He was the second best racehorse in England and was probably worth £5,000. That happened only a year ago and, when he saw him at that time, he thought he would never race again; he was still rather doubtful if the horse would stand training.

Discussion

Opening discussion on the foregoing specimens and cases, Professor Wooldridge said that, with regard to the parasites sent round by Captain Balls, he did not think there was very much doubt that they were *Ascaris*

lumbricoides, the same parasite as was found in children.

He would like to ask Mr. Spicer what was the animal from which the calculus came? [Mr. Spicer: "A small Labrador."]. He had seen and removed some thousands of calculi from the dog, but he had never seen one approaching that in size.

Professor J. G. Wright observed that Captain Balls had raised a very interesting point, as to whether *Ascaris lumbricoides* from the monkey or the dog would be infectious to man. Professor Leiper, of the University of London, in his presidential address to the Comparative Section of the Royal Society of Medicine this year, dealing with the comparative aspect of helminthology, remarked that it was a striking fact that these parasites were remarkably specific to the host in which they were found, and he mentioned the case of *Ascaris lumbricoides* in man and pig, pointing out that experience had shown that pigs could not be infested with the ova of *Ascaris lumbricoides* as obtained from man, and he (Professor Wright) thought that probably obtained in the case of monkey-man.

Professor Wooldridge thought it was much more probable that the *Ascaris lumbricoides* affecting apes in general was the same species as that affecting man.

Professor Wright: *Dipylidium caninum* was also referred to by Professor Leiper. *Dipylidium caninum* from the cat was indistinguishable from that affecting dogs, yet it was impossible to infest man with *Dipylidium caninum* from the dog, and *vice versa*.

Mr. Jones, speaking in reference to the keratoma, had said that older practitioners had had a great deal of experience with these cases, which were at one time found very troublesome. After the growth was taken away relief was obtained for a time, but one got recurrence. The speaker believed that in all these cases, if the animal was worth it, it was as well to operate, taking the whole of the horn away. Keratoma was not, he believed, a disease of the horny tissue, but of the keratogenous membrane. It was wonderful how well the foot would heal, but it was two or three months before the animal went sound again. That specimen was certainly a very fine one, and he felt that that was a very interesting exhibit, as nowadays specimens from equine cases were rather in the minority.

Mr. G. H. Livesey asked Professor Wooldridge if he could explain to them what was the nature of the skin condition in the dog which died suddenly, and if he could enlighten them further with regard to the heart affection. He understood that the dog was quite young, and how did Professor Wooldridge account for a dog of that age having valvular disease? The case raised a point of great importance, particularly to those starting in practice, who, in such circumstances, would find themselves in a very difficult position.

Professor Wooldridge replied that, in the first instance, he was absolutely unable to assign a cause of origin to the heart lesions, but he thought there could be no doubt that death occurred at that time through over-exertion on the part of the dog after getting out of the "tube" and knowing that it was nearing home. Undoubtedly it died of heart failure: the internal organs were congested, as one would expect, and the heart was distended on both sides, death occurring in diastole.

As regards the skin lesions, it was rather difficult to say what was their actual nature. Over the other parts of the body than the carpus the condition was considered by him to be a true eczema, but the true nature of the lesion on the front of the carpus was obscure, owing to the fact that it had been under treatment for some little time; in his view, however, it was a folliculitis.

Dr. J. McCunn observed that he thought that they could, having seen the specimen, explain the death of the dog, but what they would particularly like to know was, how did Professor Wooldridge explain the death to the owner? (Laughter.)

Professor Wooldridge: "That is simplicity itself. I told him the truth, the whole truth and nothing but the truth." (Laughter.)

Captain Stow enquired if Mr. Jones was really certain that the horse coming down the ride was electrocuted, Mr. Jones replying that he was certain, as he had made a careful *post-mortem* and could find no evidence of any other cause of death.

Addresses

"*Sewage: Is it a Source of Poisoning in Animals?*"—The meeting now proceeded to hear and discuss the addresses on the above subject delivered (I) by Major L. P. Pugh (from the clinical aspect), (II) by Dr. A. W. Stableforth (from the bacteriological aspect) and (III) by Dr. G. D. Lander (from the chemical aspect).

Votes of Thanks.—The President said that he would like, from the chair, to express the thanks of the meeting to Major Pugh, Dr. Stableforth and Dr. Lander for introducing, so ably, the subject discussed by the Society that evening, and also all those who had participated in the most interesting discussion to which they had listened.

The vote of thanks was carried with acclamation.

The payment of a similar tribute to those who had brought morbid specimens, and to the President for his conduct of the proceedings, terminated a most interesting meeting.

H. E. Bywater, *Hon. Secretary.*

In Parliament

The following questions and answers have been recorded in the House of Commons recently:—

HORSES (EXPORT)

Mr. YOUNG asked the Minister of Agriculture whether he is aware that horses are being exported from this country for use in bull fighting, and that the export of ponies to the Continent for the purpose of being killed for food is still taking place; and whether he will take steps to prevent the discontinuance of these practices, which involve unnecessary cruelty to the animals concerned?

Mr. ELLIOT: I have recently caused inquiry to be made on the Continent and no evidence was found that horses exported from this country are used in bull-fighting. No horses were sent from Great Britain to Spain during 1933. With few exceptions, the 358 ponies exported to the Continent last year were either high-class animals such as polo ponies, or Shetlands sent to Holland and Belgium. Three or four of the latter class are reported to have been slaughtered soon after their arrival on the Continent, and the rest were sold for working purposes. The exportation of horses is rigidly controlled by the Diseases of Animals Act, 1910, and the Exportation of Horses Act, 1914.

Mr. YOUNG: Has the right hon. Gentleman any means of ascertaining what happens to these horses when they reach Dutch and Belgian territory?

Mr. ELLIOT: We can only make such inquiries as are possible. I have given my hon. Friend the result of these inquiries in my answer.

Brigadier-General Sir HENRY CROFT: May we have an assurance that if the right hon. Gentleman gets any information regarding the export of horses for bull fights he will take instant action?

Mr. ELLIOT: Certainly, I shall be glad to inquire into any cases which may be brought to my notice.

. . . . .

LONDON QUARANTINE STATION.

Sir PERCY HURD asked the Minister of Agriculture whether arrangements have yet been made for the continuance of the quarantine station?

The MINISTER OF AGRICLTURE (Mr. Elliot): As indicated in the reply I gave on November 9th, to questions on the subject by my hon. Friend the Member for Melton (Mr. Everard) and my hon. and galland Friend the Member for Newbury (Brigadier-General Clifton Brown) the station will be continued under existing conditions until March 31st next. Following discussions with the Royal Agricultural Society of England and the Breed Societies, proposals for its continuance after that date are under consideration by the Government.

. . . . .

IMPORTED BOXED BEEF (INSPECTION)

Sir MURDOCH MCKENZIE WOOD asked the Minister of Health whether he has considered complaints with regard to boxed beef imported into this country to the effect that the absence of bones or glands makes effective veterinary inspection impossible; and, if so, whether he proposes to take any action in the matter?

The MINISTER OF HEALTH (Sir Hilton Young): I have not received any such complaints as the hon. Member refers to. The importation of boneless meat which affords insufficient means of identification with definite parts of a carcass is prohibited by the Imported Food Regulations, and under the amending Regulations of last year official certificates of inspection at the time of slaughter are now required, subject to certain exceptions, with any imported meat less than the whole carcass.

Notes and News

The Editor will be glad to receive items of professional interest for inclusion in these columns.

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DIARY OF EVENTS

Feb. 12th.—Meeting of the Editorial Committee, N.V.M.A., at 2, Verulam Buildings, Gray's Inn, W.C.1, at 4.30 p.m.

Feb. 14th.—Annual Meeting of the West of Scotland Division, N.V.M.A., at Glasgow.

Feb. 14th.—Annual Meeting of the Scottish Metropolitan Division, N.V.M.A., at Edinburgh.

Feb. 16th.—Annual Dance of the Royal Veterinary College Students' Union Society, Chiltern Hall, Baker Street, N.W.

Feb. 21st.—Annual Dinner of the Midland Counties Division, N.V.M.A., at Birmingham.

Feb. 27th.—Annual General Meeting of the Lancashire Division, N.V.M.A., at Liverpool.

July 30th-Aug. 3rd, 1934.—National Veterinary Medical Association Congress, Edinburgh.

Aug. 13th-18th, 1934.—Twelfth International Veterinary Congress, New York.

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R.C.V.S. COUNCIL ELECTION

Since our note on this matter in last week's issue two further nominations for election to Council have been received, namely, Major D. S. Rabagliati, of Wakefield, who is proposed by Major Abson and Captain R. Simpson, and Major F. J. Taylor, of Oxford, whose proposers are Major Hamilton Kirk and Captain W. K. Townson. There are now nine nominations for eight vacancies.

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PERSONAL

Mr. Bevan's Return to Southern Rhodesia

CONTINUATION OF RESEARCH INTO TRYPANOSOMIASIS

We understand that Mr. L. E. W. Bevan, until recently Director of Veterinary Research for Southern Rhodesia, has been appointed "Beit Research Worker in Southern Rhodesia," and with the assistance of the Southern Rhodesia Government will continue his researches into the trypanosomiases of man and animals in that country.

Mr. Bevan has had considerable experience in these diseases, having studied them

both in the field and in the laboratory for the past 28 years. During the first years of his service in Rhodesia he identified the different trypanosomes of animals in that country, and in 1910, contributed to *The Journal of Comparative Pathology and Therapeutics*, Vol. xxiii, No. 2, a "Note on the passage of a Human Trypanosome through Domestic Animals." This was the first description of the trypanosome which was subsequently designated *Trypanosoma rhodesiense*. In 1909, he introduced the antimony treatment of bovine trypanosomiasis which has since been universally applied and has been the means of saving the lives of many thousands of cattle. In the course of his experience he observed that it frequently happened that when cattle successfully treated returned to the tsetse-infested areas they apparently resisted re-infection, and upon the basis of this observation he devised a method of setting up a condition of "tolerance" or "premunity" against natural infection. On Mr. Bevan's retirement from the Government Service his work in this connection remained unfinished, and it is to enable him to continue his investigations that the Beit Trustees and the Southern Rhodesia Government have created the appointment above referred to.

During the later part if his period of residence in this country Mr. Bevan has served as a member of the Editorial Committee, N.V.M.A., most ably and fittingly filling the grievous gap left by the death of Mr. Eustace Montgomery. In consequence, the Committee continued to benefit by the presence of a well-informed enthusiast in Colonial veterinary matters (for no one has been more assiduous in his attendance), while the last report of the Committee to Council bore testimony to their appreciation of his valued services in reviewing reports from overseas. Mr. Bevan's return to a sphere of activity upon which he has already left an indelibly progressive mark, while a great gain to veterinary science, is a severe loss to the Committee he has served so well.

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On Leave.—Messrs. W. Fotheringham, M.R.C.V.S., Veterinary Research Officer, Agricultural Department, and R. A. Hammond, M.R.C.V.S., Veterinary Officer, Agricultural Department, are on leave from Kenya Colony and Protectorate.

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R.C.V.S. OBITUARY

Broomhead, William, 34, Milton Avenue, Highgate, N.6. Graduated New Edinburgh, December 14th, 1895; died February 1st, 1934, aged 64 years.

Death of Mrs. Amy Penhale.—The Western Morning News records the death, at the age of 71 years, of Mrs. Amy Penhale, widow of Mr. William Penhale, M.R.C.V.S., a well-known Holsworthy veterinary surgeon, who was succeeded in the profession by his son, Mr. R. H. Penhale. This succession completed the fourth generation of the family as veterinary surgeons.

Another son, Mr. J. Penhale, M.R.C.V.S., holds an appointment under the Ministry of Agriculture and Fisheries at Exeter.

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VETERINARY INSPECTION IN DORSETSHIRE

Dorset County Agricultural Committee has decided to recommend Dorset County Council to appoint four whole-time veterinary inspectors to carry out the inspection of dairy herds throughout the county. The cost of this service will be £2,600.

SHEEP SCAB IN NORTH DERBYSHIRE

Although tens of thousands of sheep were rounded up in November and given a double dipping there have been several fresh outbreaks of sheep scab in North Derbyshire.

The position has become so acute that four experts from the Ministry of Agriculture have been drafted into the district in an endeavour to stamp out the disease.

Hundreds of sheep are having to be dipped again, and all the sheep on the moors are being rounded up for examination.

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TORSION OF THE PREGNANT UTERUS IN THE COW

A correspondent writes: "Will any veterinary surgeon who knows of any method of correcting torsion other than by rolling the cow, kindly state the method in the columns of *The Veterinary Record*?"

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ARMY VETERINARY SERVICE

London Gazette—War Office—Regular Army

January 26th.—The following to be Lieuts. (on probation) (January 27th):—D. F. G. Smith, R. S. T. Bowden, L. R. Morford, A. D. Seton, I. H. Chalmers.

February 2nd.—Lieut. (on prob.) M. M. Healy resigns his commn. (February 1st).

Correspondence

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The Editor does not hold himself responsible for the opinions of his correspondents.

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N.V.M.A. SWINE FEVER ADVISORY COMMITTEE

To the Editor of The Veterinary Record

Sir,—It is not my intention to enter into a controversy on that most engrossing subject, swine fever diagnosis, a subject which is occupying and puzzling the brains of veterinarians throughout the world, but to point out that certain statements in Mr. Beckett's letter of the 3rd inst. appear logically to be somewhat lacking.

As my name is specifically mentioned I am constrained to reply in a more or less personal strain, much as one dislikes newspaper controversy with its frequent concomitant statement of half truths, which, whilst not intended to mislead so often do so.

Field experience (referring to the second paragraph of Mr. Beckett's letter) postulates experience of animals in health and disease under all sorts of field conditions; "field," in this sense, meaning to imply the conditions and usages employed by the men engaged in the pig industry. In my own case this experience has embraced the whole of Great Britain for the last 25 years, all breeds and types of pigs (from that of the humble cottager to the finest pedigree herds in Great Britain), and at all seasons of the year, yet my experience "has of necessity, been confined within narrow limits."

The third paragraph of Mr. Beckett's letter might also have been better expressed, as one cannot see how an intimate knowledge of pigs and pig diseases can at the same time be superficial. Intimate knowledge of a subject, if it

means anything, implies deep and extensive knowledge, *ergo*, how can it be superficial?

Mr. Beckett (also in para. 3 of his letter) urges the need for consulting men who combat diseases of all kinds in swine. Presumptively the only disease a man of my experience and outlook can see is swine fever, but surely one must have some knowledge of other disease conditions in swine "gleaned within narrow limits" before one can limit oneself to the diagnosis of swine fever.

Mr. Beckett's Utopia of a full description of the differential diagnosis of swine fever is not yet, and whilst, with my "narrow limit" outlook, I can, and do, occasionally help practitioners in the "field" over the differential diagnosis stile, it is somewhat difficult to express in writing, and transmit to the reader, that gift of experience.

Without wishing to cause offence, I would like to suggest to Mr. Beckett that the last paragraph of his letter is not just in the best of taste, and likely to cause offence to the various members of committee who so ungrudgingly give of their valuable time for the cause of the Profession.

Mr. Beckett, like others of us, is seeking after truth, and carping criticism is not exactly the best method of obtaining it.

Yours faithfully,

J. O. Powley.

9A, York Road,
Harrogate.
February 6th, 1934.

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REFLECTIONS UPON AN EDITORIAL

To the Editor of The Veterinary Record

Sir, Your contemporary *The Veterinary Journal* has definitely gone over to the Soviet régime which I foreshadowed in my petition to the Council of the N.V.M.A., in June last. Its short editorial in the January number is wholeheartedly in favour of a *whole-time* State Veterinary Service. The *Journal* (1) says that this service has definitely and without a shadow of of doubt come to stay, for the counties of England are energetically moving in every direction for County Veterinary Inspection, and it strongly advises graduates to apply for posts in that service.

The *Journal* (2) puts this whole-time service on a par with the *panel practice* of the sister profession, which, it says, came opportunely to the members of the medical profession. Actually, the schemes are as opposite as the poles, and as far apart.

Then there is (3) a strong recommendation to the young graduate to spend an extra year in obtaining the D.V.S.M.

It has been deplored that this question of inspection has split the profession in two—general practitioners *versus* whole-time men. The *Journal* has now accepted this fact and has definitely ranged itself on the side of whole-time Service.

As to No. 1, it is only too true that many counties are appointing whole-time men who are taking away the legitimate work of the general practitioner, and I am glad to see, in the current *Record*, that some, at least, of the whole-time men are realising this, and express a pious hope that the condition may, in some measure, be mitigated. The discussion on the Joint Committee's recommendation at the last Council meeting of the N.V.M.A. is my authority for that statement.

Concerning No. 2, the comparison of panel practice with whole-time Veterinary State Service, let me quote from the Annual Report of the Chief Medical Officer of the Ministry of Health for the year 1932, issued in 1933, and the last report to date on the Insurance Medical Service, otherwise panel practice. "The conditions of service are essentially those of *private practice. Every qualified and registered medical practitioner is entitled to have his name included in the list of practitioners undertaking the treatment of insured persons, and the insured person is free, as in private practice, to choose his doctor subject to consent of the doctor to accept him.*"

From the beginning it has been, and remains, the policy of the Ministry of Health to work as far as possible in friendly co-operation with the Insurance Committee of the British Medical Association as the body most fully representative of insurance practitioners. The number of insured persons is 16,010,000, the total number of practitioners doing this work is 16,783, and the cost £8,961,936 per annum, *of which* £6,734,050 *represented the remuneration of practitioners* (which gives an average of roughly £400 per annum to each practitioner). The Regional Medical Staff consists of five Divisional Medical Officers who supervise the work of 34 Regional and 43 Deputy Regional Medical Officers—a total of 82 whole-time men. The whole staff is under the supervision of one Senior Medical Officer and one Deputy Medical Officer, and these are under the Chief Medical Officer of the Ministry.

The staff, amongst other things, inquire into such matters as applications by practitioners for *grants* to enable them to attend post-graduate courses, and *special grants* to practitioners in sparsely populated districts where the medical needs of the inhabitants could not otherwise be met. *In a number of cases where the nature of practice makes it difficult, or impossible, for the doctor to earn a competence grants are made to ensure the continuance of a satisfactory medical service in the areas concerned.* Other grants are made to assist doctors to instal telephones, to maintain motor-cars, and to open branch surgeries.

Facilities for post-graduate study, and access to the medical teaching centres are unavailable to doctors in many rural districts except at great personal inconvenience, and at relatively high expense in providing "locum tenens." *Grants are made for this.*

Is there any comparison between panel practice as summarised above, where 16,000;000 patients are attended by 17,000 general medical practitioners who are supervised by 82 whole-time men, and a State Veterinary Service, carried out, at present, by 13 Chief Veterinary Officers (13 counties) and 28 Assistant Veterinary Officers in England and Wales, this representing 13 supervisors to 28 assistants—"some" difference!

The comparison amounts to this:—

Panel Practice

1. *Every* general practitioner is eligible.
2. Patients can choose their own doctors.
3. Doctors can choose their patients.
4. Conditions those of private practice.
5. Central staff, three medical officers; and Regional staff 82 whole-time men.
6. General practitioners employed, 17,000.
7. Remuneration to general practitioners £6,734,050.
8. Grants for post-graduate study.
9. Special grants to keep general practitioners in sparsely populated districts.
10. Grants to instal telephones.
11. Grants to maintain motor-cars.
12. Grants to open branch practices.
13. Grants available for "locum tenens."

State Veterinary Service

1. *No* general practitioners.
2. Inspection compulsory.
3. Inspectors *must* go where they are sent.
4. Conditions those of whole-time service.
5. No central staff. Forty-one at present, but probably about 600 when all counties are fully staffed.
6. General practitioners *nil.*
7. General practitioners *nil.*
8. Grants *nil.*
9. Grants *nil.* General practitioners will leave sparsely populated districts.
10. Nil to general practitioners.
11. Nil to general practitioners.
12. Nil to general practitioners.
13. Nil to general practitioners.

Nos. 7-13 all apply to general practitioners.

Regarding No. 3, the Diploma of Veterinary State Medicine, let us see what the Chief Medical Officer of the Ministry of Health says concerning this: "The State and the community will gain substantial benefit *when every medical man is effectively educated in preventive medicine.* This does not mean that *every* medical student should be trained as a public health expert, but that every student should understand the purpose and practice of preventive medicine as applied to the individual and the community." Again, "No one can consider these new medical duties without perceiving that they are profoundly changing the character of medical practice, and almost unconsciously moulding it into a co-operative organised and national plan. Such a change may not be wholly advantageous . . . but it can be made advantageous by the knowledge and skill of the medical practitioner. . . . *It brings the doctor into an organised health service; it lays upon him statutory duties in the public interest.*"

The Veterinary Journal practically recommends an extra year's course of study. Surely five years is enough. As to this, I consider that this post-graduate diploma should not be necessary. As, according to the *Journal,* it *is* necessary, then the teaching at the schools is to blame.

A graduate of to-day who has facilities and teaching never thought of in my day, over 40 years ago, should not require an extra diploma to carry out these inspections, as the curriculum of the schools covers every subject of the Diploma in Veterinary State Medicine. Let us compare the two:—

School Curriculum.	D.V.S.M.
Examination B.	Epizootiology.
Stable management.	Bacteriology.
Examination C.	Protozoology.
Pathology, Bacteriology and Protozoology, Materia Medica and Toxicology, Veterinary Hygiene and dietetics.	Veterinary Hygiene. Toxicology. Meat and milk inspection.
Examination D.	
Veterinary Medicine and meat inspection.	

Where is the difference? The subjects are the same, but the balance is in favour of the school curriculum.

The diploma of the M.R.C.V.S. should be sufficient to enable a young graduate, with a little practical experience, which even the holder of the D.VS.M. has to acquire, to have the special as well as the general knowledge required for the carrying on of a State Veterinary Service.

To my mind, this part of the editorial is a serious reflection on the eminent professors who teach, and on the students who are taught, for it shows an inability on the part of the latter to assimilate the teaching given to them.

I have the honour to be, Sir,
Your obedient Servant,
J. W. Hall Masheter.

Ruddle House,
Newnham-on-Severn.
February 1st, 1934.

The Editor acknowledges, with thanks, the receipt of the following:—

Communications from Lieut.-Colonel J. A. Dixon (Leeds), Mr. J. W. H. Holmes (London), Mr. Allan Leslie (New Zealand), Mr. N. P. Male (Sonning-on-Thames), Major W. S. Stevens (Southsea), and Professor G. H. Wooldridge (London).

Report of a meeting of the North of England Division, N.V.M.A., from Captain J. R. Rider, Hon. Secretary.

Diseases of Animals Acts, 1894 to 1927

SUMMARY OF RETURNS

Period.	Anthrax.		Foot-and-Mouth Disease.		Parasitic§ Mange.		Sheep Scab.	Swine Fever.	
	Outbreaks confirmed.	Animals attacked.	Outbreaks confirmed.	Animals slaughtered as diseased or exposed to infection.	Outbreaks reported by the Local Authorities.	Animals attacked.	Outbreaks confirmed.	Outbreaks confirmed.	Swine slaughtered.
	No.	No.	No.	No.	No.	No.	No.	No.	No.
Period 1st to 15th January, 1934	12	12	—	—	13	20	95	63	27
Corresponding period in									
1933	11	13	20	1,342	13	27	48	31	4
1932	18	25	—	—	13	20	29	99	28
1931	19	20	—	—	12	29	33	55	10

Note.—The figures for the current year are approximate only.

§ Excluding outbreaks in Army Horses.